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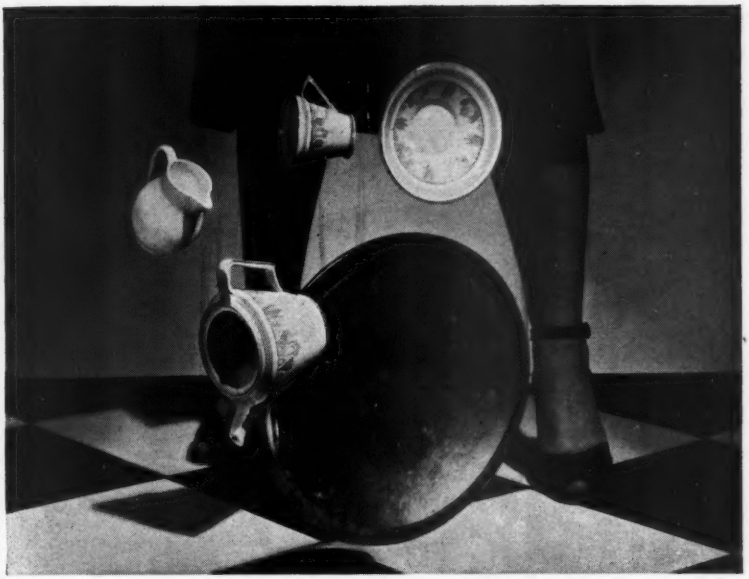

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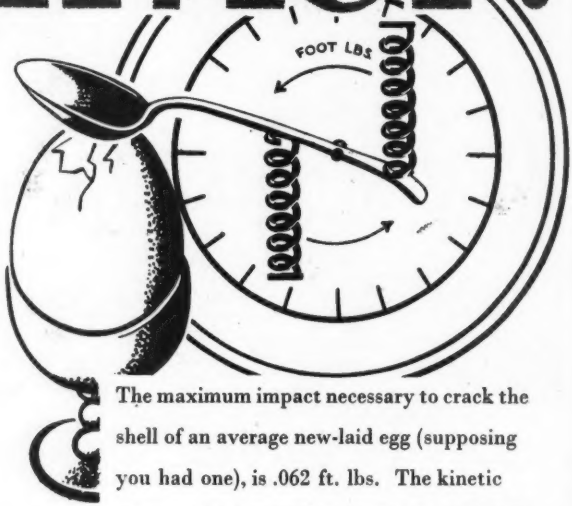

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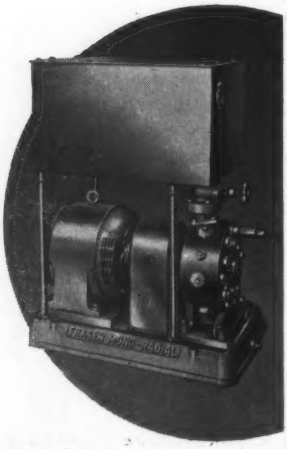

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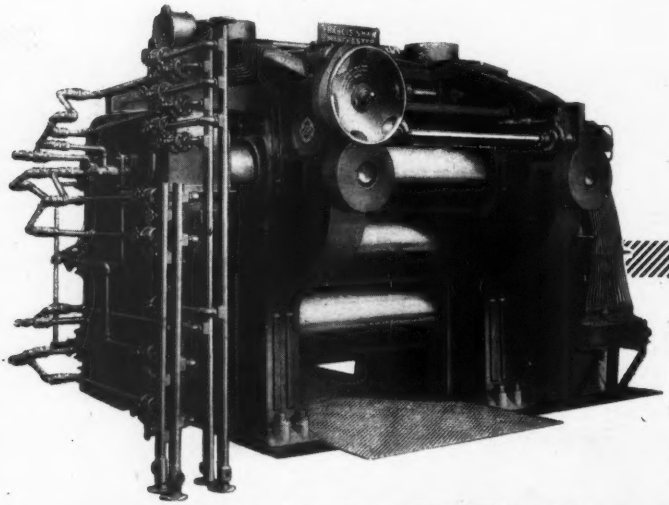

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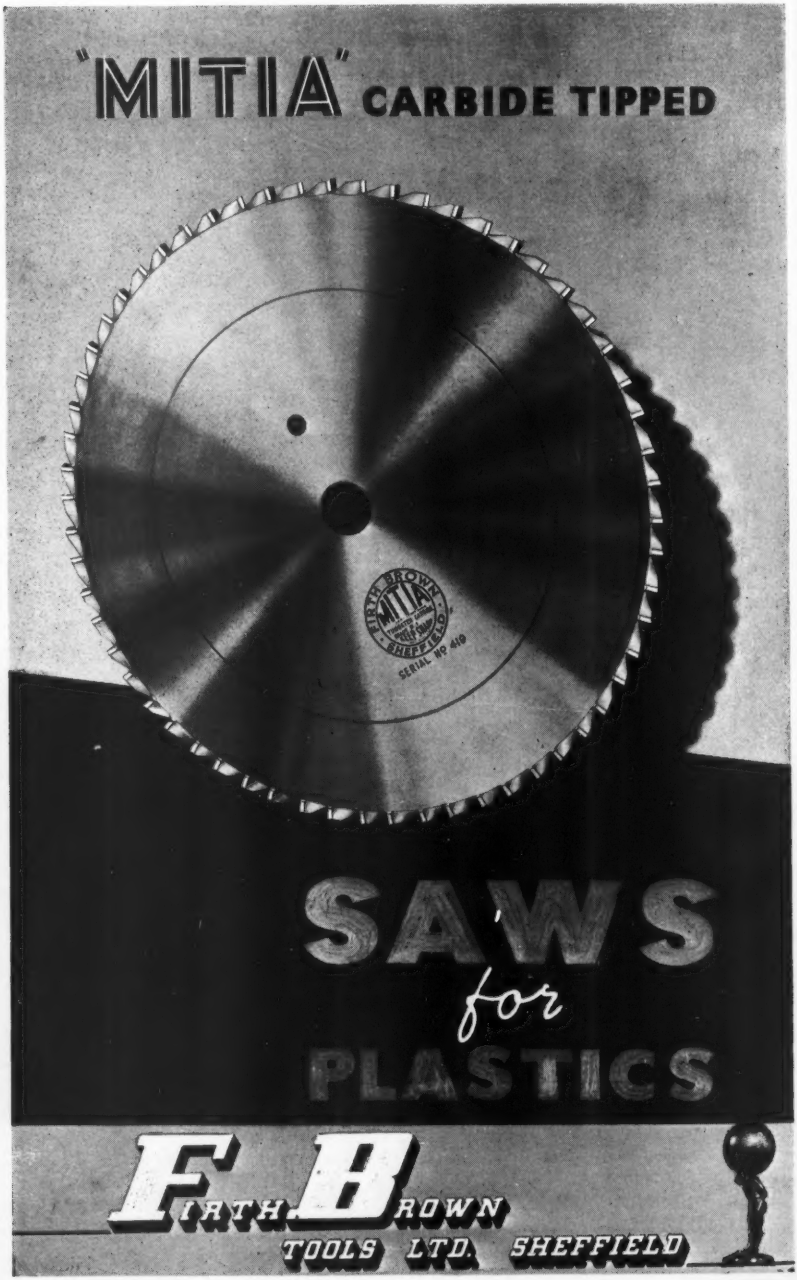
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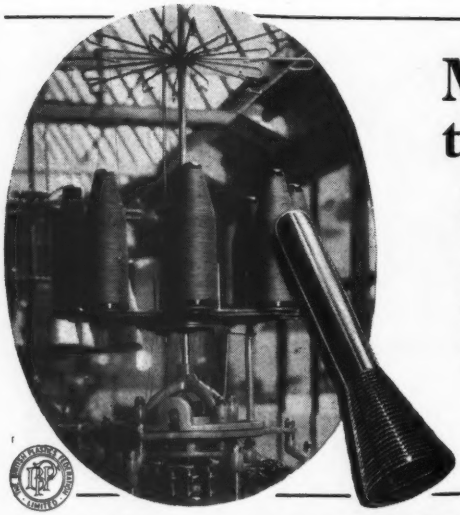

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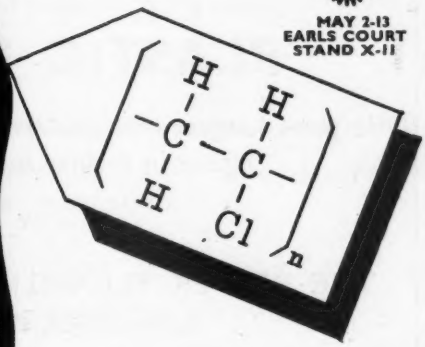

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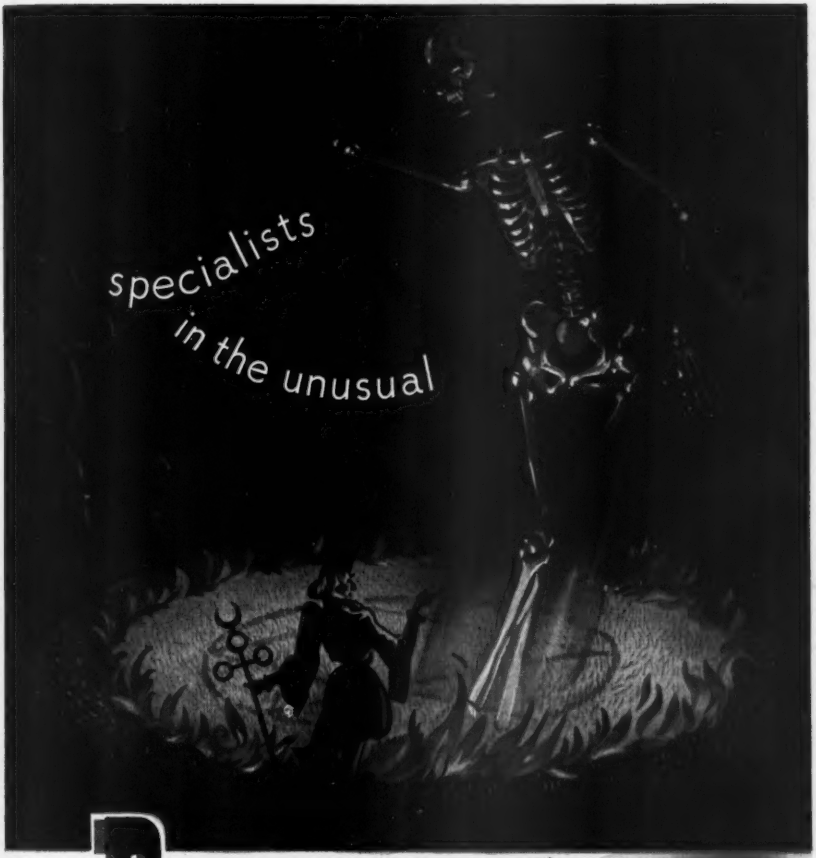

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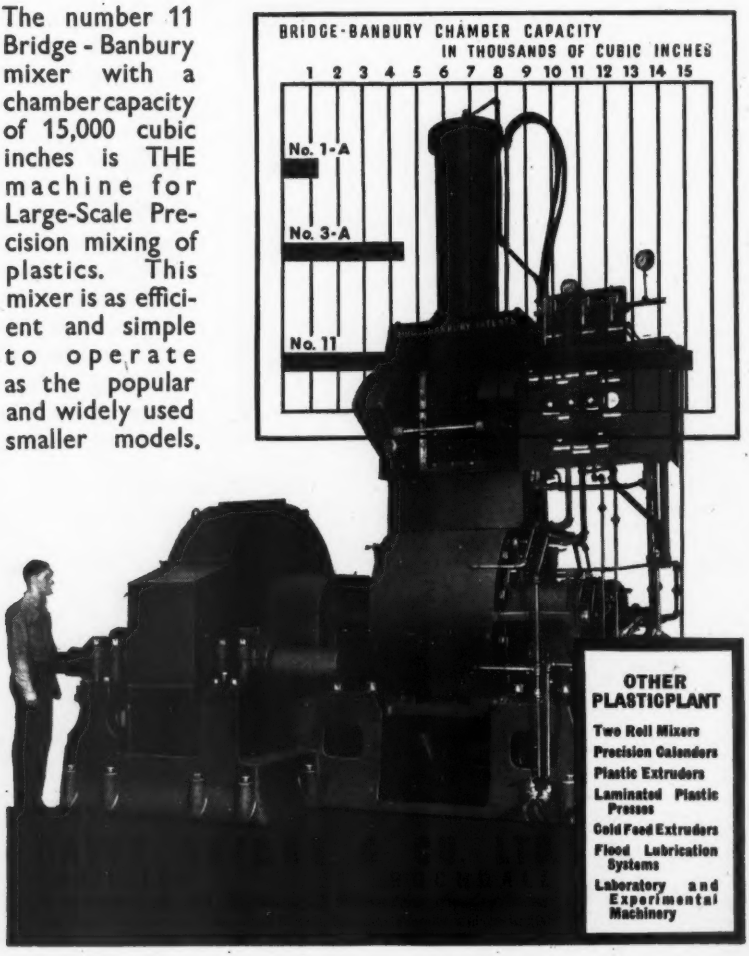

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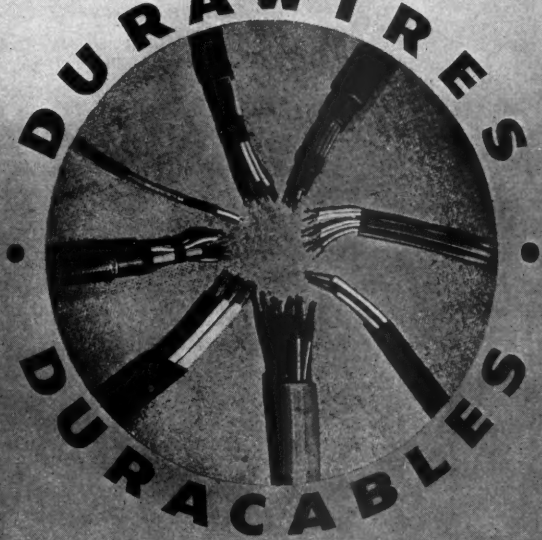

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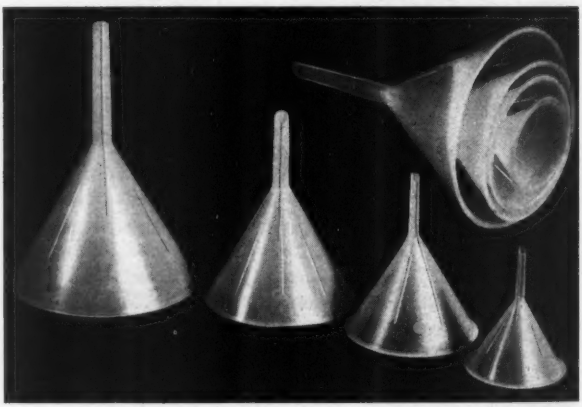

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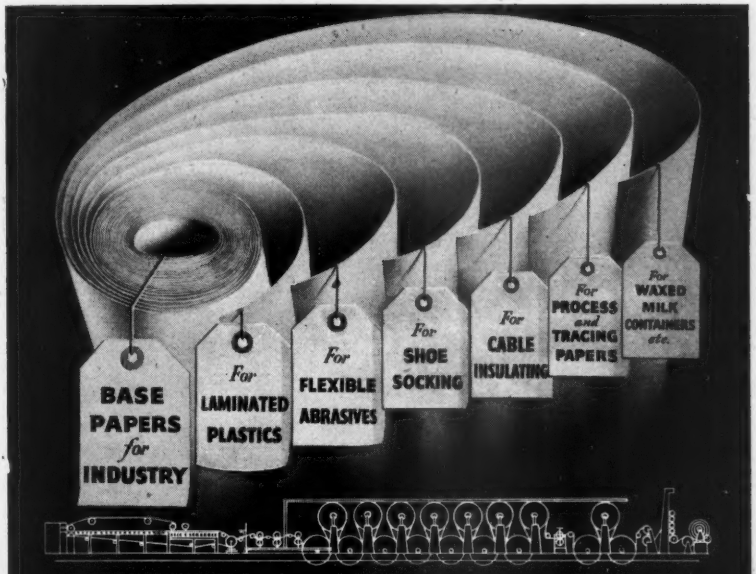

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Vol. XIII. No. 143. APRIL, 1949

Plastics

Dealing with the Manufacture, Uses and Potentialities of Plastic Materials

Proprietors - - **TEMPLE PRESS LIMITED**
Chairman and Managing Director **ROLAND E. DANGERFIELD**

Editor - - - **M. D. CURWEN, B.Sc., A.R.I.C.**
Offices - - **Bowling Green Lane, London, E.C.1**

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EDITORIALS

British Industries Fair

ON May 2 to 13 we shall once again see Britain's industry shop window open for inspection to our friends here and from abroad.

While we have every sympathy for the exhibitors during the three or four weeks preceding the opening—for it is then that publicity managers lose hair and age rapidly—yet for the visitor it is a time of excitement and expectation. Whatever his branch of industry or job, engineer or furniture maker, builder or toy maker, textile manufacturer or hotel manager, fancy-goods dealer or electrical engineer, packing expert or exporter, they are all learning more and more about plastics, some slowly, some fast, and they all hope to pull something new to them out of the bag.

We may be sure there is something in it, for most of them—new and improved raw materials, new "semi-finished" types and the hundreds of novel finished goods that have just been, or are about to be, launched on the market.

But it is because we are in business to sell our goods and for no other reason that the B.I.F. must attract and educate at one and the same time. This is no simple matter, always remembering that by its very nature the plastics industry is now of fundamental importance to so many industries and is always expanding. Stand arrangement is therefore of supreme importance and, judging from past experiments we have seen, the buyer is not always able to see the wood for the trees. The jumble sale is never attractive and rarely educational.

As for the past year, it is idle to pretend that it has been one of serene skies and sunshine only. By and large, it has been difficult—the promised buyer's year—and since no relief from overwhelming taxation is made from income or purchasing, it will continue to be difficult.

In spite of it, however, there are signs of what, under any conditions, would be called a healthy movement. The plastics industry itself is calling more urgently than ever for quality production, and the cream of the industry, which is large enough, is showing the way to do it. Furthermore, the low-quality types that reared their ugly heads in the immediate post-war years have largely disappeared in the subsequent shake-up. So, too, have the useless gadgets and whatnots which never should have been made of plastics.

Yet another sign is the rise of competition once again both in mould making and in the moulding industry itself, which can prove the healthiest sign of all. If it is coupled with a maintenance of high quality and thought behind the design, then the buyers will not be found wanting.

On pages 191-197, we present all buyers with a guide to our own windows on industry.

Plastic Water Pipes Under Test

MORE than 12 years ago we announced the advent of extruded p.v.c. tubing, and its use for the conveyance of beer; some seven or eight years later came the employment of polythene tube, with greater inertness to the action of fluids, for the same admirable purpose, and it needed no bearded soothsayer to foretell its promise as a means of conveying water.

Now, while the cynical British may remark that there appears to be little difference between the chemical constitution of these two beverages, it will be obvious that the problem of water-piping systems for houses needs the more careful consideration.

Although it is certain that the use of such piping has been helped considerably by the world shortage of lead and other

metals (after another war lead would probably join the ranks of the rare and precious metals), theoretically at any rate there has always been good reason to suppose that polythene or some similar plastic would be a " cert " for water-piping whether metals were in short supply or not. For would not the cry " No more busted pipes " find its echo in every true Briton's heart?—hearts that while they may be of oak yet, for more than 100 years, have cringed in the thraldom of King Plumber and his forgotten spanners. Can we hang him and his mate on the old apple tree? Not yet, although that may come. We must go carefully and examine all the disadvantages, as well as the advantages.

For the past two and a half years polythene (and we believe cellulose acetate-butyrate) has been under test as piping installation for cold water in certain houses in the Coventry area, and a generalized statement (which does not represent any " official " view of the Coventry Corporation Water Undertaking) has been issued. In spite of its unofficial nature, it is interesting and valuable, and is to be commended, especially for the necessary caution with which the tests have been made—the experiments involve the determination of liability to failure with freezing, the possibility of taste being induced, and the effect on bacteriological impurity. The following is the subject matter of the statement.

These tests have been generally favourable, but it should be borne in mind that such an examination cannot be considered as conclusive, and there is no evidence as to the durability of this material and liability to deterioration after a prolonged period of use. The reactions of this and other plastic materials may vary with differing waters.

There is a danger in attributing the performance and characteristics of any one type of plastic piping to plastic pipes in general, having regard to the very wide range of plastics and the completely differing qualities of the various materials coming under this designation.

Standards are laid down for gas and water piping in the established materials, and piping manufactured to these standards is accepted for general use, but in a new field there are naturally no standards. With a wide variety of different materials or combinations of materials at the disposal of manufacturers, it is to be feared that some manufactured products may be good and others bad, and wholesale approval of plastic pipework would obviously be dangerous in consequence.

In the Waterworks Industry, " sounding " on fittings attached to metal pipework has previously provided a valuable means of detecting leakages or water running to waste. The use of inert materials in pipework would therefore render the work of waste detection more difficult.

There is another complication in the common practice of earthing electrical apparatus and installations to water pipes. If, due to misunderstanding or ignorance, plastic pipework is used as a presumed means of electrical earthing, an obvious danger will result.

Insufficient is as yet known about fixing and jointing plastic pipework generally and there are obvious limitations in the use of thermo-plastic materials.

The ease with which plastic pipework can be cut or distorted may have an irresistible attraction to children and other irresponsible persons, and rats and mice may also find the material attractive.

The characteristic advantages of plastic materials lie in their high resistance to corrosion, the flexibility and adaptability of certain types, ease of jointing and fixing, and in certain cases resistance to frost damage due to elasticity. These advantages, coupled with the world shortage of lead and the desirability of conserving other metals normally used for pipework, may be considered to offset the disadvantages which can be foreseen, but whereas the disadvantages have yet to be proved. This may induce a conservative attitude towards this new development, which may not be justified.

The main point is that the experiments are well under way and they will teach us much.

High-speed Boxmaking

ON page 183, Mr. Vivian Stannett describes in the current article of his series on cellulose acetate, the "Trans-Bo-Matic" machine which he has examined during his temporary stay in the U.S.A. It is a new and ingenious device for the rapid production of boxes from acetate sheet—at the rate, in fact, of about 1,000 boxes per hour.

On first reading his typescript some six weeks ago we imagined that it would be a long time before we could see one in this country. Judge our surprise when two weeks later we received an invitation from Cascelloid Ltd. to see a "Trans-Bo-Matic" at their works in Leicester.

We went, and there, working full out (it has on occasion attained a rate of 1,100 boxes an hour), was the very first to be installed in any works—we understand it was the prototype manufactured by the American Tool Works Company, Ohio, U.S.A. The second is now being completed in America. In addition, therefore, to Mr. Stannett's adequate, detailed analysis of the machine, we have pleasure in publishing on page 218 a photograph of it in the Leicester works.

In congratulating Cascelloid Ltd. on this step, it is only necessary to add that it does not seem as if this country is always backward in adopting very new plant.

Mould Making by Precision Casting

A NEW advance of exceptional importance in the field of mould production has been announced by B.I.P. Tools, Ltd., and as a result of a recent visit to the works of this company in Birmingham we are able to give a preliminary general assessment of the development which may well revolutionize the economics of the plastics moulding industry.

The idea of producing precision metal moulds by the method of casting has long been a dream of every mould maker in the world, and in recent years this dream has been followed by the production of a few experimental moulds of very small size—so small, indeed, that they have been regarded rather as a preliminary step to a hopeful future than as the solution of many of our economic problems.

To-day, precision casting of medium-sized moulds is an accomplished fact. There appear to be no limits to the type of metal which can be employed and the results compare favourably with traditional high-class machining, often surpassing it so far as fidelity of reproduction of delicate detail is concerned. The examples we saw during our visit to the works of B.I.P. Tools, Ltd., were exceptionally praiseworthy.

Since the stage of producing medium-sized moulds has been reached and since the time of production of them by casting is but a small fraction of that taken by machining, the benefits that will accrue to the plastics industry in general are obvious.

We hope to enlarge upon this subject in our next issue.

Ideas from the Past

WE have just re-read a chapter from one of the works of J. H. Fabre, the famous French entomologist, who lived from 1823-1915. It is the particularly gruesome one on the manners of the bluebottle and its habit of leaving eggs (whence maggots) in the poultry and game exposed in shops conducing neither to the highest demands of hygiene nor to the best methods of salesmanship.

He suggested the use of the paper bag which protects the bird completely, but adds: "There is, of course, a serious objection to this. In its paper shroud, the article is invisible; it is not enticing; it does not inform the passer-by of its nature and qualities."

Will somebody tell our butchers and game dealers what Fabre said in 1880, and tell them we now have transparent wrappings?

A New Type of Helmet for Firemen

AS the result of research by the D.S.I.R. and Fire Offices' Committee Joint Fire Research Organization, a new type of helmet may soon be used by firemen. It is made of woven glass fabric, impregnated with resin, and is considerably better than the existing helmets. The new helmet combines lightness and safety with comfort and smartness.

Most of the helmets now in use are made of leather or of cork. Their design springs from the old brass helmet, and each one is a complicated piece of construction which can be done only by specially trained workers. In most ways they are satisfactory, but are bulky in use and their form of construction makes them liable to failure if they come into contact with high voltage current. The leather helmet is heavy to wear for long periods. In addition, both leather and cork are fairly easily penetrated by sharp objects.

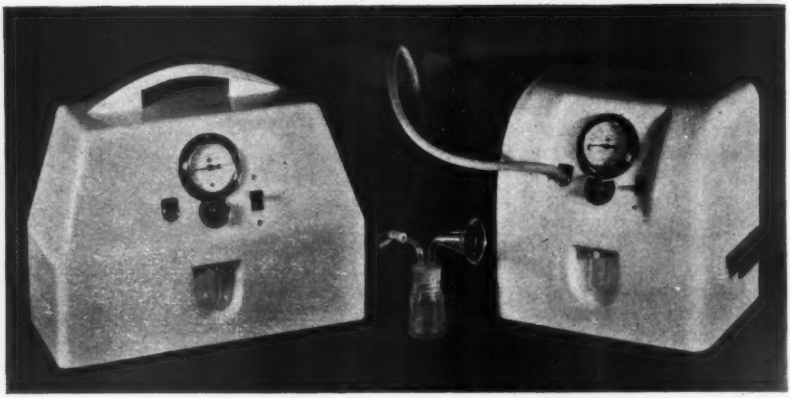
The ideal helmet has to be capable of many things. It must protect the fireman from debris, such as bricks and timber, falling from above, and also from objects with a shearing edge, such as glass splinters, slates, or metal. As some of this debris may be hot or burning, the helmet must also be strongly resistant to heat and flame. It must not conduct electricity, for the fireman may have to work among electric cables. Consequently, it must resist a current of at least 10,000 volts, both when dry and wet.

When in use, the helmet must throw falling debris and water clear of the face and neck, but must not obscure the wearer's vision. It should be comfortable and firm on the head, as light in weight as possible, and well ventilated. It must also be constructed to allow the interior to remain as cool as possible.

A special feature of the new helmet is a patent form of resilient head lining. This takes part of the impact of any weight falling on the helmet, but avoids the use of holes in the shell and, therefore, improves its electrical resistance. The new helmet has been put through rigorous laboratory tests and has been found to possess all these properties, but before being generally recommended, it has to be tried out at actual fires. Firemen in the London area and elsewhere have recently been using prototypes of the helmet under these conditions.

Tennis Court Markings

Permanent marking of tennis courts, hockey pitches, etc., is facilitated by the introduction of a new plastic white tape which is easily nailed into place. Made of polyvinyl chloride by De La Rue Extrusions, Ltd., this tape is marketed by the En Tout Cas Co., Ltd. It is supplied in the correct lengths, with scientifically designed and spaced holes and white-topped galvanized iron nails so that it may be laid with the minimum of trouble. The p.v.c. has excellent weathering qualities, and does not become stained or dirty with use.



Right : New model " Emesay " breast pump with " Perspex " cabinet.
Left : Old model in metal case.

Moulded Case for Medical Appliance

By H. H. GOULDING*

THE application of plastic materials in the medical and surgical field is somewhat limited; first, because they are unable to withstand the rigours of hospital sterilization and, secondly, because a break in the use of conventional materials is frowned upon by the medical profession in general.

The opportunity does arise on very rare occasions whereby certain types of equipment can be modernized and new materials, especially plastics, used. A particular instance of a successful application of plastics, and complete modernization of a medical unit, is seen in the suction-pump case here illustrated. This case houses the working parts of a unit used in maternity cases for the development of breast milk, and as a prophylactic against mastitis.

Moulded in opal O3O " Perspex," the case is exceedingly attractive for use in maternity wards, and any nervousness of a patient to the use of a machine is greatly reduced by the pleasing appearance of the unit.

The earlier models of suction-pump units, which were first introduced into hospitals in Great Britain by the Medical Supply Association, Ltd., consisted of the entire working parts being exposed to full view, with the result that patients were able to observe the unit in operation. This was a fact which did not escape attention; the apparatus was redesigned and modernized in every possible way, the whole being enclosed within an attractive all-metal cabinet finished in cream enamel and so constructed that it would hold all of the accessories. This in itself was considered to be a great step forward in producing a unit which would appeal to nurses and patients alike, and overcome the many disadvantages of the earlier model.

The trend in design and modernization, however, was only just beginning, and over a year ago experiments were being undertaken with the object of improving the mechanical working of the unit, reducing it in size and modernizing

* Plastics technician to the Medical Supply Association, Ltd.

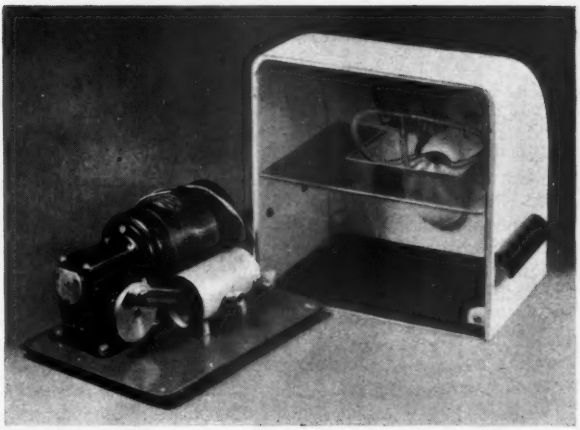
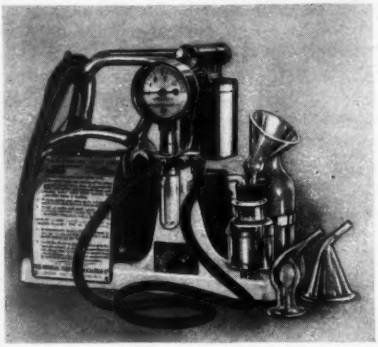


Fig. 2 (right).—The new "Perspex" case viewed from rear, with motor and pump which is housed inside the case.

Fig. 3 (below).—The original form of the apparatus.



the case still further to bring it into line with present-day trends.

To describe in accurate detail the many problems that arose during the design stage would take up too much space. However, it may prove of interest to readers to learn that the actual design as illustrated was accomplished in roughly one hour, after which certain technicalities regarding storage space, location of controls, and the exact positioning of strength reinforcements, were discussed and finalized.

The success of development on the unit was a result of close collaboration between moulder, technicians and designers, and a true understanding of plastic materials.

The introduction of this new model renders a double service; first, by making available to hospitals a unit of reliable and proven design, which will, it is hoped, raise the prestige of British medical equipment throughout the world. Secondly, as a means of publicizing plastics and encouraging still further their correct application in the field of surgery and medicine.

The moulded "Perspex" case has many advantages, among which the following are worthy of note:—

(1) Recessed instrument panel avoids protrusion of controls.

(2) Single curvature front and radiused corners eliminate the possibility of damage through rough treatment.

(3) Two carrying handles ensure equal distribution of weight.

(4) Polished surface of case can be maintained by occasional washing.

(5) Attractive appearance of "Perspex" case will have considerable effect in maternity wards by reducing the nervousness which patients invariably show to medical appliances.

It is desired to express thanks to Thermo-Plastics, Ltd., Dunstable, who are responsible for moulding the case, and to the Medical Supply Association, Ltd., London, for permission to publish this article.

Ebonite Mouldings for Water Meters

THE water meter industry in this country, with the help of British ebonite mouldings, is steadily invading markets which were formerly an exclusive German monopoly. This highly-skilled British industry, manufacturing thousands of precision-built water meters each month, is now expanding rapidly to fulfil overseas contracts. For instance, the Rotherham factory of Guest and Chrimes, Ltd., one of the leading members of the industry, is now turning out twice the number of meters which they exported pre-war.

There is not a large home market for water meters, due to the abundant supply of water, although they are used for bulk supplies and sometimes in agricultural areas. In certain countries abroad where there is shortage of water, however, each dwelling house often has its own meter.

Before the war almost the whole of the German firms engaged in the manufacture of water meters were amalgamated into a "water meter trust" whose combined output was at least ten times that of the British makers. With the help of subsidized exports the Germans were able to obtain an almost complete monopoly of the foreign markets. As many of these German factories have been destroyed, British industry is now taking advantage of this situation to become established in the water meter industry.

At an early stage in the industrial revolution water meters were of the piston displacement type. More than one hundred years ago, however, Guest and Chrimes were manufacturing a meter of the inferential type, as designed by a Berlin firm. Continual advance in design led up to the point, after the first world war, when it seemed no further advance could be made in reliability and sensitiveness unless some material other than metal was used.

Water meters of all-metal construction have certain disadvantages, due either to the corrosive action of some waters on

Fig. 1 (above)—Moulding for ½ in. dial chamber.

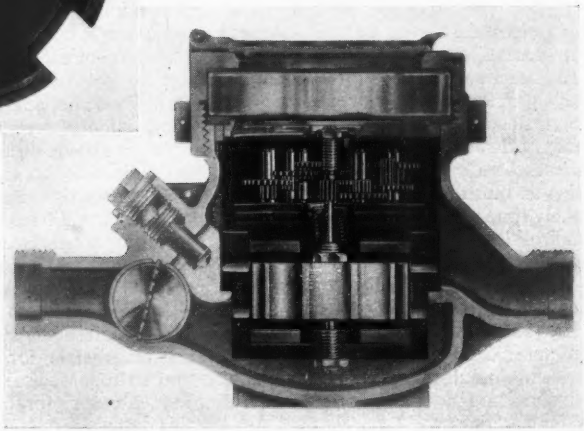


Fig. 2 (right)—Section through a water meter showing the ebonite parts.

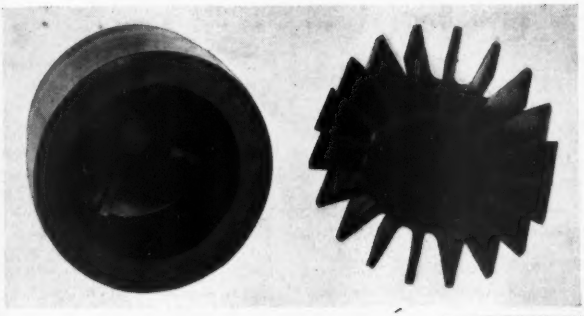


Fig. 3 (left)—Mouldings for ½ in. capstan fan chamber and 1½ in. fan wheel.

Fig. 4 (below)—Moulding for 1 in. piston chamber.

the metal parts, or owing to the weight of the moving parts. By using ebonite mouldings, however, the corrosion difficulty was overcome, and as ebonite itself is much lighter than metal both accuracy and sensitiveness of the meters was improved. Ebonite is strong, and does not absorb water—water, indeed, is the natural lubricant for this material. Further, as the ebonite parts do not corrode, they can be cleaned and put back into service to give many more years of useful life.

Since the war the ebonite industry in this country has expanded considerably and at the works of United Ebonite and Lorival, Ltd., at Little Lever, thousands of water meter parts are moulded each week. Our illustrations show some of these ebonite parts which have helped British industry to capture so much of the former German market in water meters.

No difficulties are experienced in the moulding of the ebonite. The tolerances allowed are quite liberal, because all essential parts subsequently are machined and polished. Circular mouldings remain "dead" on coming from the mould, but other mouldings, such as the lids, have a rather large shrinkage. Nevertheless, ebonite used for these water meter parts has to have certain properties indicated by experience and a special grade has been developed to meet these needs. The precise composition of this special grade is not disclosed, but it has a tensile strength of 4,500 lb. per sq. in., and the impact strength, by the Izod notched test, for a ½-in. by ½-in. strip is 0.25; coefficient of expansion is 0.000077 per degree C.; water absorption (cold), 0.02 per cent. in 28 days.

Experience shows that this particular grade of ebonite has very good machining properties, and it is left with an excellent surface finish. One point which needs to be specially borne in mind is that the moulded parts must show no possible warping when in use. It is a matter which has closely engaged the attention of United Ebonite and Lorival, Ltd.

SCOTTISH INDUSTRIES EXHIBITION

This exhibition will be held at Kelvin Hall, Glasgow, September 1-17, 1949. Primary object is to give Scotland the opportunity to develop still further the progress made industrially in recent years. The Exhibition offices are at 351, Sauchiehall Street, Glasgow.

PLASTICS IN GERMANY

The New Target in Germany is the Science behind the Industries. The following are additional Notes from the Official Reports which can be obtained from H.M. Stationery Office.

B.I.O.S. Final Report 811.—Production of vinyl chloride and polyvinyl chloride at the Dr. Alexander Wacker works, Burghausen, is described, together with details of certain items of plant. The monomer was processed in stainless steel or enamel lined vessels as ordinary mild steel is apt to induce a certain amount of polymerization. A solution of one of the polymers, Vinol H, (20 parts) in 55 parts of ethyl acetate and 25 parts of toluene had a viscosity (Hercules) of one second, and was used for lacquer as a sealing coat to prevent migration of plasticized p.v.c. to nitrocellulose adhesives in shoe making.

B.I.O.S. Final Report 1175.—The interrogation of Dr. A. Kraus regarding synthetic resin emulsions and cellulose lacquer, as set out in this report, includes the answers to a large number of questions submitted by representative members of the British Plastics Federation, among whom Bakelite, Ltd., Courtaulds, Ltd., Beck, Koller and Co., Ltd., BX Plastics, Ltd., Ioco, Ltd., and Vinyl Products, Ltd. Typical formulations for lacquers are included.

B.I.O.S. Final Report 1794.—The preparation of synthetic resins for use as surface coatings is described, based on processes employed at Chemische Werke Albert, Wiesbaden. One of the raw materials for special phenol-formaldehyde coating resins is an intermediate, diphenylol propane, the manufacture of which is also described. There is a general note on the use of polyhydric alcohols other than glycerine for esterification. Throughout the whole German surface coating resin industry, a tendency to use glycerogen, hexane-triol, and other polyhydric alcohols has been noticed, and questions have been raised as to the advantages shown by these materials over glycerine. The main disadvantage, however, is that they generally give rise to low melting points in modified phenol-formaldehyde types as well as in alkyd types. Glycerogen is manufactured (I.G.) by the catalytic high-pressure hydrogenation of sucrose.

F.I.A.T. Final Report 1110.—This report covers the German methods of producing polyvinyl alcohol from polyvinyl acetate. Some uses of polyvinyl alcohol are also described. Casting solutions are prepared by dissolving polyvinyl alcohol in distilled water at 80-90 degrees C. to form a 33 per cent. solution, subsequently adding plasticizers (if used). The solution is filtered through cloth in an aluminium filter press, and is collected in an enamelled vessel, where it is allowed to stand for several days at the same temperature to de-aerate. The clean de-aerated solution is cast on a simple belt casting machine, the belt of which is a wire screen cloth which has been coated with multiple layers of polyvinyl acetate emulsion, thus giving a smooth replaceable surface to which the polyvinyl alcohol will not adhere. The casting is stripped from the machine and placed in an air drier at 60-80 degrees C. until dry, and subsequently at room temperature for several days. This material forms the starting product for further fabricating operations. The unplasticized material is extremely tough and hard; principal applications are hammer heads, motor couplings, stamping plates, or matrices. Regarding plasticized materials, those which are stretched but not treated with acid are very strong in the direction of stretching and when thin are quite flexible; applications include belt laces (which are said to be superior to chrome tanned leather) and thin strips for woven upholstery. The stretched and acid-treated materials have the greatest flexibility; principal application is for machine driving belts. For high-speed drives, as in the woodworking industry, it is claimed that these belts are superior to leather; in continuous use at low or moderate speeds the performance is inferior to leather, because moisture is lost, although in intermittent operation the moisture can be regained during idle periods.

F.I.A.T. Final Report 1142.—A new type of spray drier said to be particularly suitable for polyvinyl chloride is described. In this drier, by Nubilosa Meissen, the liquid is sprayed into fine mist by means of a rotating stream of compressed air, and drying is accomplished by a concurrent, rotating stream of hot air. In normal cases the dried p.v.c. is in the form of hollow spheres with an average diameter of $\cdot 5 \times 10^{-3}$ cm., and thickness of shell 5×10^{-4} cm.

Evolving New Types in Plastic Travel Goods

By Warnett Kennedy,
D.A., A.M.T.P.I., M.S.I.A.

THE development of plastic travel cases has increasingly engaged the attention of both the plastics and travel goods industries since the war. Following the showing of a prototype travel case in the "Future" Section of the "Britain Can Make It" Exhibition, interest has been whetted by the appearance on the American market of various types of moulded luggage. Closer inquiries, however, reveal that many technical and cost problems await solution before it can be truly claimed that the era of light moulded luggage has arrived.

In America, industrial designer Egmont Arens has experimented with "Co-ro-lite," a sisal fibre plastic-preform material, and another designer, Morris Sanders, has produced an attractive travel case in laminated cellulose acetate within an aluminium frame. These and other developments have been carried to the prototype stage, and some are being tentatively tested on the market.

We are already familiar, however, with the use of p.v.c. for bags, straps, pipings,

Woman's "Rev-Robe" in "Fibrenyle" plastic material, as designed for W. Wood and Son, Ltd., by the author.

extrusions, linings and moulded corner pieces. Phenol-formaldehyde compression-moulded handles are common, together with handles machined from paper-laminated thermosetting material. Coat hangers are injection moulded from cellulose acetate, polystyrene and other materials. A complete travel case in post-formed fabric-laminated Bakelite has also been on the market, although the design made use of the material only as riveted sheet.

In this country, W. Wood and Son, Ltd., have taken a leading part in research and design. Moulded cases now on the market are the result of collaboration between J. F. Parrott, director and works manager of W. Wood and Son, Ltd., in charge of their research and development, Fibrenyle, Ltd., and the author, as consultant industrial designer. By working as a team it has been possible to correlate exact knowledge of the requirements of the travel goods industry (including questions of cost and fittings), the technique of preparing and shaping "Fibrenyle" material, and the new designs and æsthetic considerations which are necessary to obtain eye-worthy and saleable products.

"Fibrenyle" cases, of course, are only one solution of the general problem of using plastic materials. This development, however, can be considered a substantial step towards the desired objective. "Fibrenyle" is a thermoplastic material with sufficient structural strength to be used for small and medium-sized travel cases; large-mouldings might require special safeguards against warping and fracture. It weighs 38-48 lb. per cubic ft. and has a tensile strength of 5,000-7,000 lb. per sq. in. Moreover, it is supplied in sheet form and its special virtue consists in the ease with which complex shapes can be formed without power or pressure, employing inexpensive formers of cement or plaster of paris. The drying-out of the preform sheet is accelerated by radiant heating, by electricity, or by steam.

While the material itself can be produced in a range of thicknesses and colours, the suitability of the decorative finishes can only be considered in relation to the products made therefrom. At present W. Wood and Son, Ltd., are only using "Fibrenyle" as a "shell" in travel goods, leather, leather cloth, textiles and other decorative veneers being applied to the surface.

Used as a shell or core, the plastic material makes little difference to the visual form, although observation of detail—the rounded corners, elimination of surface attachments and careful cambering of the plane surfaces—combine to refine appearance. The practical advantages occur in the course of manufacture. The following comparison of the operations necessary to the manufacture of a leather "Rev-Robe" and a "Fibrenyle" "Rev-Robe" will help to elucidate this point:—

Leather	Fibrenyle
Cutting leather	Cutting leather
Cutting lining and lining stiffeners	Cutting lining and lining stiffeners
Cutting plywood	Veneering "Fibrenyle" shel
Bending and shaping plywood	Stitching case
Pinning, taping, and glueing plywood	
Fixing stiffening frame in body	
Cover leather	
Stitching leather	
Trimming leather	Trimming leather
Stitching lining	Stitching lining
Mounting lining	Mounting lining
Glueing lining	Glueing lining
Fixing external and internal fittings	Fixing external and internal fittings

The above comparisons make it clear that the main problem of making the shell of the case has, in moulded technique, been transferred from the travel goods manufacturer to the plastics manufacturer, thus allowing the former to step up his output and save skilled labour.

It is stressed that the present "Fibrenyle" case should be considered only as an interim development; it is already clear that future developments might well include moulded studs, elimination of linings and internal fittings, the elimination of veneers, new design possibilities and other advantages intrinsic in moulding technique, as compared with traditional sheet technique.

World's Industry Employs Plastics

GENERAL ENGINEERING

Bearings. — H. Kalpers reports on bearings consisting of steel brasses and a thin plastic foil of 0.008 to 0.015 in. thickness. Such bearings are made in short lengths, and are suitable for replacing ball bearings which are in short supply in Germany. (" Kunststoffe," 1949/Dec./253.)

Punched silicone products have a wide range of applications in many fields of industry. They comprise gaskets, washers, seals and packings (Stalwart Rubber Co., Bedford, Ohio), which can be used in processing systems handling hot or cold fluids or gases and wherever rubber comes into contact with extreme hot or cold conditions. (" Materials and Methods," 1949/Jan./105.)

Laminated materials. — Practical examples of the use of synthetic-resin laminated sheet for jigs and fixtures emphasize the non-warping and wear-resistant properties of these materials, particularly for gauges and templates used in the woodworking industry. (" Machinery," 1949/Jan. 20/80.)

Impact tests.—L. Feoppl reports on tests with bars of " Dekorit " supported on their ends, subjected to impacts by a falling weight. The test results with impacts of moderate intensity are compared with theoretical data. (A.S.M.E. Paper No. 48-A24.)

Sandwich panels.—R. A. Miller and H. L. Langhear have studied the flexural strength and stiffness of wood-aluminium sandwich panels. General efficiency varied inversely as the core density. Balsa-wood proved to be the best core. (" Prod. Eng.," 1949/Aug./104.)

Preforming and moulding press of 55 tons capacity can produce 50 preforms per minute in round or odd shape, plain or with bored hole, the largest size being 3-in. cell depth and 3-in. diameter. Of welded-steel construction, all moving parts are enclosed. (" Machine Tool and Blue Book," 1949/Feb./262.)

Laminates.—Flow sheet No. 182, by J. Zeelander, deals with the fabrication of the impregnated fabric to the end product in the form of tubes, rods, sheets, panels or mouldings (" Mechanical World," 1949/Feb./211.)

Surface resistance.—W. Krassowsky compares the testing of the surface resistance of plastic products as carried out in England and Germany. It is admitted that the English recommendations contain some improvement against the German rules. The influence of the electrode distance needs further investigation. (" Kunststoffe," 1949/Dec./251.)

Cork and rubber laminate.—New vibration-isolating material, " Elasto-Rib " (Korfund Co., Inc., 48-15 Thirty-Second Place, Long Island City I., N.Y.) is composed of a layer of cork bonded between two layers of deep-grooved oil-resistant synthetic rubber. Recommended loading is between 7 and 21 lb./sq. in. (" Machinery " (N.Y.), 1949/Jan./189.)

Styrene pipe, withstanding working pressures up to 650 lb./sq. in. at temperatures up to 100 degrees F., will safely handle water, natural or manufactured gas, organic solvents or alkalis. Standard dies, tees, elbows and joints are used. The makers of this " Extrulite " pipe are Extruders Inc., Culver City, Calif. (" Materials and Methods," 1949/Jan./75.)

Moulds.—L. J. Morrison recently presented a paper to the Society of the Plastics Industry on the selection of the proper steel material for the cavities in

moulds. He discussed the characteristics of alloy-carburizing steels, oil- and air-hardening steels. Stainless steels should be used where high polish is necessary. Improved steels for hobbing have been developed. (" Machinery," 1949/Jan./180.)

MISCELLANEOUS

Goggles comprising a one-piece plastic lense (Willson Products Inc., Reading, Pa.) serve for eye protection in woodworking, grinding, spot-welding and similar light-duty operations. The design offers wide vision and ample eye protection. Both flat and curved lenses are available, and are produced in either clear or green acetate. (" Machine Tool and Blue Book," 1949/Feb./204.)

Shockless hammer. — A non-recoil hammer (H. F. Soderling Co., 1745 Fourth Avenue, South Seattle, U.S.A.) provided with plastic tips of " Tenite " can be used on lacquered surfaces without marking them. The hollow-metal head is filled with steel grit. The blow is said to be 30 per cent. harder than that of an ordinary hammer. (" Business Week," 1949/Jan. 29/52.)

Motor housing.—For a 2 oz. battery-operated motor (Aragin Products, Inc.) (7,000 r.p.m., 1/100 h.p.) is injection moulded in two sections from " Lumarith XF " (cellulose acetate). (" Materials and Methods," 1949/Jan./75.)

Bone replacement.—A satisfactory substitute for human cartilage and bone for use in repairing damage due to accidents, burns and facial deformities has been found in polyethylene. Only chemically pure polyethylene is employed. (" J. Plastic and Reconstr. Surgery," Abstract in " Mech. Engineering," 1949/Jan./33.)

Protective mask consists of a plastic shield held in position by an adjustable elastic head band and replaceable laminated filters of great thickness. Mask weighs only ½ oz. and is said to protect throat, nose and bronchial tubes from large particles of non-toxic dusts. The makers are General Scientific Equipment Co., 2700 W. Huntingdon Street, Philadelphia. (" Mod. Mach. Shop," 1949/Feb./327.)

Fishermen's clothing.—Practical results with a weatherproof clothing made of polyvinyl chloride (Mipolam) are reported. After one year's use the clothing became stiffer, as the plasticizers apparently were saponified and washed out. (" Kunststoffe," 1948/Dec./253.)

Metal lacquers.—C. H. Ott investigates the possibilities of the " Araldite Lackharz 985 E " for the surface protection of metals. Araldite resins (Ciba A.G., Basle, Switzerland) consist of derivatives of ethylene oxide, which can be polymerized and hardened. A phenolic reaction product can be obtained by the actions of epihalogen hydrin on the derivatives of ethylene oxide. Chemical and physical properties are discussed and some indications for the practical application are given. (" Schweiz. Archiv. f. angew. Wiss. and Technik," 1949/Jan./23.)

Avoiding misapplications.—K. Rose discusses the possibilities of overcoming certain misapplications of plastics. He discusses three main possibilities: (a) During the war inferior substitute materials were used; (b) there was lack of sufficient knowledge of service conditions; and (c) an unfortunate use of a low-price substitute material. (" Materials and Methods," 1949/Jan./64.)

Plastic behaviour.—R. Gaeth surveys the structural principles of the thermoplastic materials with reference to their plastic behaviour and describes the most important production and manufacturing methods. (" Kunststoffe," 1949/Jan./1.)

Soft plastic foil.—As a supplement to former investigations, H. Koch, A. Loehr and K. Stoeckhert have reported on the time dependency of the tension-elongation test using notched samples. (" Kunststoffe," 1949/Jan./9.)

Cellulose Acetate Plastics

XX.—Container Fabrication (Contd.)

By
Vivian Stannett

BEFORE discussing the manufacture of seamless containers by drawing and dipping techniques, the first fully-automatic machine to be developed for the production of seamed rectangular boxes will be described.

Automatic Box Making

It is now nearly two years since this machine was first described* and the first machine built has now been working around 10 hours a day for this period. In that time it has made about 2,000,000 complete boxes, and so the machine can safely be said to have proved itself. The machine referred to is the "Trans-Bo-Matic" automatic box-making machine manufactured by the American Tool Works Co., Ohio.

The principle of the design of this machine is based on copying the series of manual processes involved in box making as described in Section XIX of this series, and fitting them together as one automatic machine. An overall view of the machine is shown in Fig. 1. It can be seen from this illustration that the cellulose acetate film is fed into the machine in the form of a continuous reel; from then on, the fabrication proceeds in the following stages:—

(1) The sheet is cut to a rectangle of the correct size.

(2) The corners are cut out to give the correct blank for the box.

(3) The sides of the box are creased or "crimped" with two 90-degree bends.

(4) The box is twisted round on its base by 90 degrees, and the final two 90-degree creases are made.

(5) The overlaps are cemented and sealed in the correct position.

Finally, the finished box is carried forward and ejected into a suitable receptacle. The speed of production is of the order of 1,000 pieces per hour. The size of the box can be varied, within the limits given in Table 1, by changing the setting of the machine.

Cutting Initial Rectangle of Film

The first unit of the machine cuts off a strip of film from the reel of the required length; this stage of the process is illus-

* "Modern Packaging," 1947/**20**(10)/102; "Modern Plastics," 1947/**24**(10)/123.

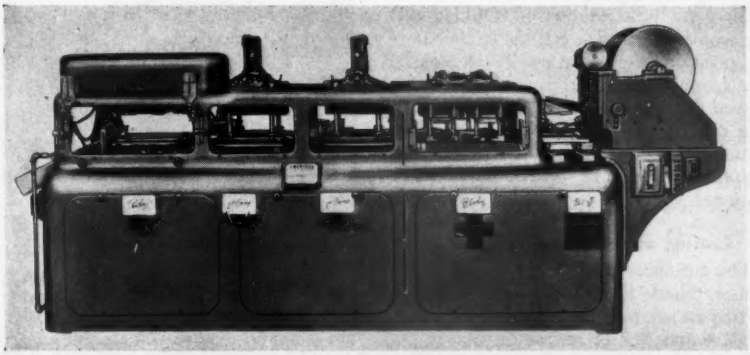


Fig. 1.—"Trans-Bo-Matic" automatic box-making machine. (Courtesy, American Tool Works Co., Ohio, U.S.A.)

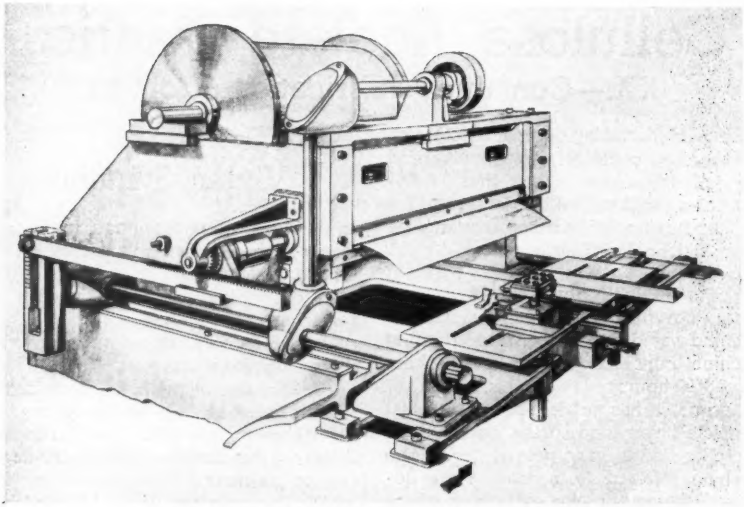


Fig. 2.—Cutting off the initial length of film from the reel.

trated in Fig. 2. As can be seen, a rack and pinion mechanism feeds out the correct length of film, the width being controlled by the width of the reel. Before cutting, the film is fixed by suction on to the moving block, using nine rubber suction-cups. The piece of sheet is then cut and is carried on to the next stage on the suction block, which travels round by means of the chain device shown on the right of the diagram. The cut piece of film stays with this particular block until, finally, the finished box is tumbled off; the empty block then returns to the starting position to pick up another length of film from the reel. In order to eliminate curved film arising from "setting" of the film on the reel, it was found that best results were obtained if the reels were supplied on a core of at least 9 ins. diameter.

Cutting and Creasing the Blank

The cut sheet travelling forward on its suction block is seen in Fig. 3. It is carried 24 ins. on to the blanking position (Figs. 4 and 5). Here, the table lifts the indexing block from its chain socket and simultaneously raises the lower dies up

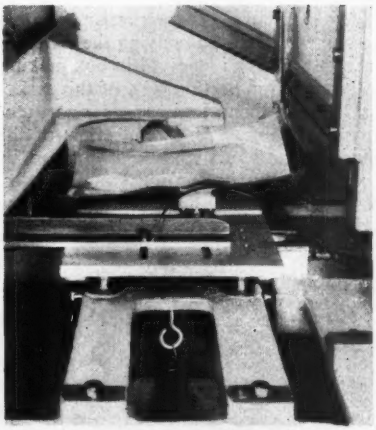


Fig. 3.—Cut sheet travelling forward to corner cutting station.

Table 1.—Size Limits of "Trans-Bo-Matic" Box Making Machine

	Maximum	Minimum
Thickness of material..	0.020 ins.	0.005 ins.
Roll size ..	14 ins. wide × 500 ft. long	3½ ins. wide × 1,500 ft. long
Blank size ..	14 ins. × 14 ins.	3½ ins. × 3½ ins.
Box size ..	13 ins. × 13 ins. × ½ in.	2½ ins. × 2½ ins. × ½ in.
Box height	4 ins.	½ in.

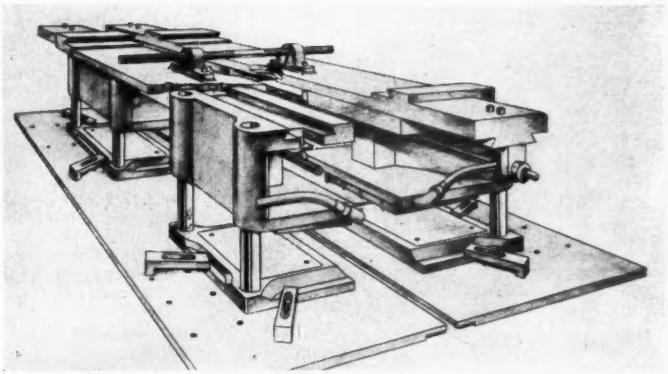


Fig. 4.—Blanking (corner cutting station) : the table rises, pressing sheet against the upper half of the corner stamping dies.

against the sheet; finally the upper half of the dies is met with and the four corners are cut from the sheet. The cut corner pieces are automatically blown clear of the machine. After cutting, the blank is lowered again with its block on to the chain socket and carried along to the first creasing position.

The creasing is carried out by means of long-heated parallel blades which bend up two opposite sides of the box and also mould about a 1/16 in. bead along the edge to make a more rigid box. This slight elaboration is reputed to double the crushing strength of the box as compared with ordinary creased sides. Figs. 6 and 7 show details of the action of the creasing blades and dies. The box must now be turned through an angle of 90 degrees in order for the second creasing station to make the final bendings. This twisting is carried out in an ingenious manner by a simple device whose mechanism is well illustrated in Fig. 8. When turned at the correct angle, the box is again creased as before to the shape ready for sealing as shown in Fig. 9.

Sealing and Ejection

In order to maintain a production rate of 1,000 complete boxes per hour, it was found that only about 3.5 seconds could be allocated for the whole sealing process. This was finally achieved by a most original and ingenious sealing mechanism. A male former, correspond-

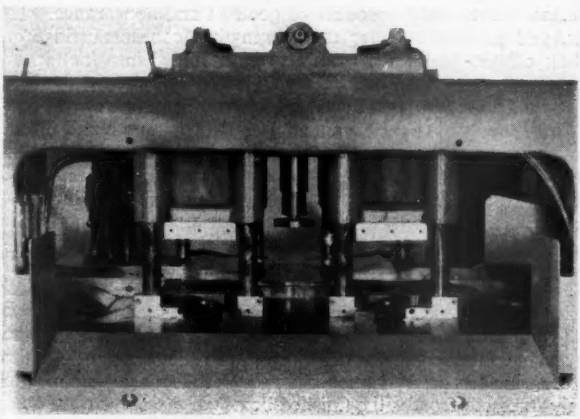


Fig. 5.—View of corner cutting station, showing the four dies.

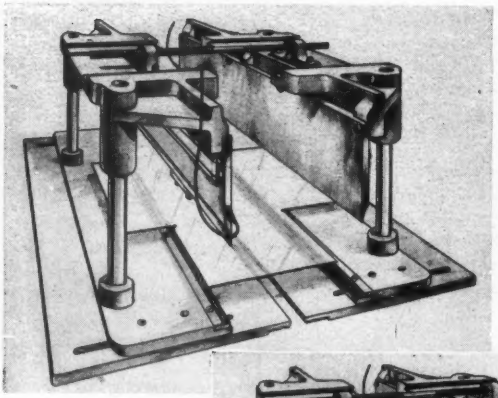


Fig. 6 (left).—Creasing mechanism : heated creasing blades open.

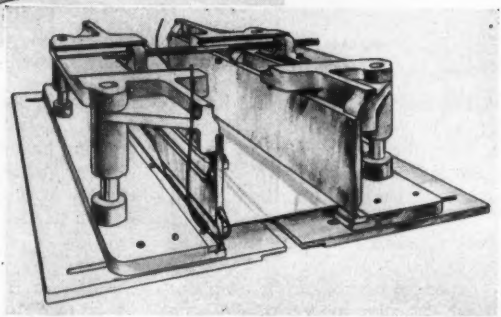


Fig. 7 (below).—Creasing mechanism : heated creasing blades closed to apply pressure for moulding-in beaded crease by die.

ing to the size of the box is necessary, and at the sealing stage a moving table carries up the suction block and the cut and creased blank and fixes it in the operating position as shown in Fig. 10. Here, four porous metal wicks print a line of solvent along the vertical edges of the box, then a set of moving arms force the overlaps of the box over on to the sticky part of the box. Pressure pads hold the overlaps in position against the cemented strip for half a second and then release themselves. The table thus descends, and air-driven ejector pins force the box off the male former on to the suction cups; these carry the box forward again, when finally two arms strip the box free from the suction cups and it rides forward into the receptacle on an endless belt. Fig. 11 illustrates this last process. The suction cups and blocks ride round on the chain to the beginning again.

Pressing and Deep Drawing

This method is most useful for the mass production of shallow cylindrical containers and/or lids for such containers. Very shallow cylinders of ¼ in. or so in depth are usually merely pressed from sheet, the loss of thickness being too small to affect the strength and rigidity of the structure. Highly polished and accurately made male and female tools are necessary to give a transparent product of good fit and appearance. To give extra strength a concentric ridge or two can also be moulded into the top or bottom disc.

For deeper containers or for shallow containers of superior strength and finish, it is best to use drawing technique. This is in many respects similar to sheet-metal drawing, only the die is heated in order to soften the plastic film. The metal male former is usually left cold or even water-cooled. This pushes down the softened film into the mould. The sheet is held down by a pressure plate which allows film to slip into the mould during the forming process, so that substantially the same thickness results at all points on the finished box.

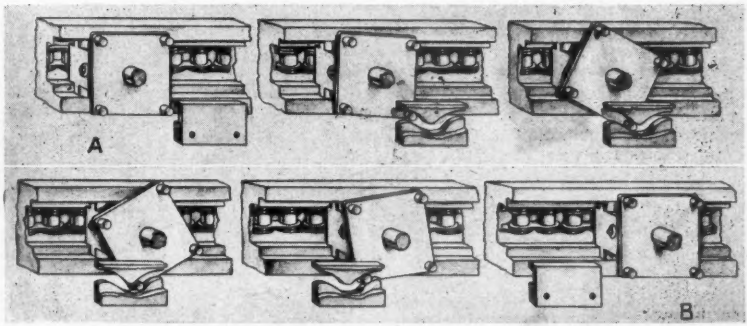


Fig. 8.—Mechanism for turning box through 90 degrees prior to second creasing, i.e., from position A to position B.

The adjustment of pressure on the holding down plate is the most important part of the process. Too little pressure results in wrinkling of the film, whilst too much pressure leads to thinning and usually tearing of the film. In order to prevent trapped air from accumulating, small vent holes are drilled through the male former.. The heating of both simple pressing and deep drawing tools can be effected either by steam, oil or electricity, the latter being by far the most common at the present time.

Both types of container moulding are very well suited to the continuous production of articles from reel or film. The film can, of course, be pre-heated by a battery of infra-red lamps or other suitable means, but this is not usually necessary for film of 10 thousandths-of-an-inch thick or less. The moulded box is usually automatically cut off at the angle by a cutting die which is mounted on the plunger right above the base of the former. The container is automatically blown clear of the tool after cutting. About 1,000 pieces per hour is regarded as a good production rate for this type of machine. The finished box or lid can finally be beaded, using the normal rotating disc method as described earlier in this series—a method which can also be readily mechanized to keep pace with the production rate.

The depth of containers which can be made by deep drawing technique is usually described as being limited to about one-half of the diameter, but in actual practice few containers or lids deeper than ¾ in. or so appear to be made by the

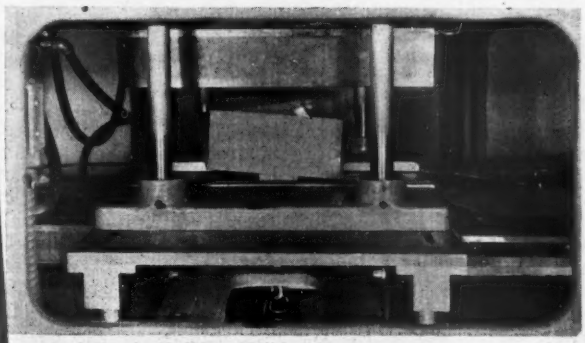


Fig. 9.—The completely creased box at the second creasing section ready for moving to the final sealing position.

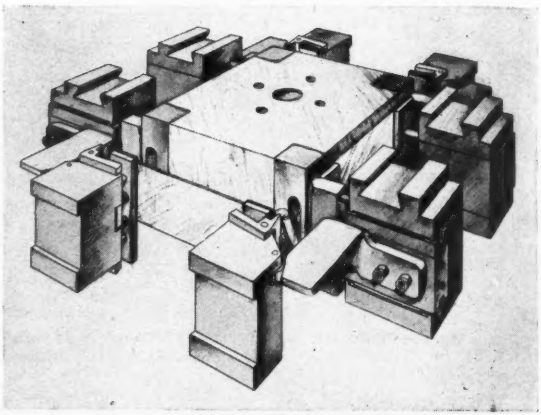
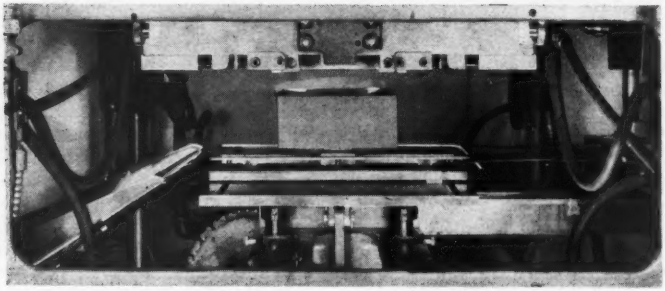


Fig. 10 (right).—Sealing position : the box in position over the male former.

Fig. 11 (below). — The completed box prior to its ejection from the machine.



automatic drawing method. One of the chief outlets at the moment for drawn pieces is that of lids for the deeper seamed cylindrical containers made by semi-manual processes. Some commercially available deep drawing machines, especially designed for transparent container manufacture, are illustrated in Figs. 12 to 14.

Dipped Containers

This method is based on technique used in the dipped rubber-goods trade, although considerably changed and modified to suit the special properties of cellulose acetate. Its use for cellulose acetate container manufacture is restricted to a remarkably small number of companies. These have kept the details of the method secret, although the broad principles are well known.

In brief, glass or polished metal formers are dipped in a thin solution of cellulose acetate and plasticizers in a solvent, usually acetone. A battery of formers or moulds is then raised and the solution allowed to dry, followed by further dipping until the correct thickness of film is deposited on the mould. When perfectly dry, the film is stripped from the mould and trimmed down to size and finished off as desired.

Practical difficulties are encountered with regard to depositing a clear, glossy coating on the mould and also in stripping the coating from the mould. Details of the methods employed are either heavily protected by patent or are kept as well-guarded secrets by the manufacturers concerned. Typical containers made by dipping technique are illustrated in Fig 15. The big disadvantages of the dipping

Fig. 12 (left).—Commercial deep drawing machine for transparent cellulose acetate containers up to 10 ins. diameter. (Courtesy, Taber Instrument Co., Inc., U.S.A.)

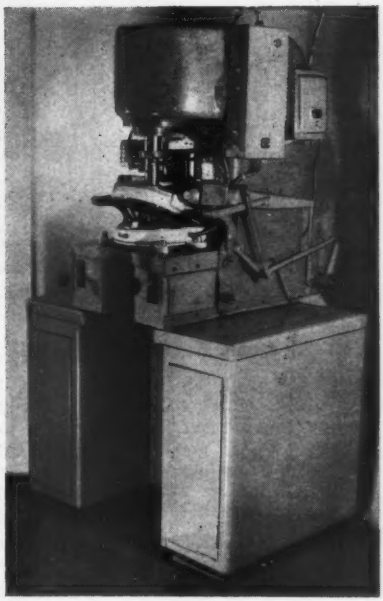


Fig. 14 (above).—Commercial deep drawing press, electrically heated and controlled, for containers up to 4 ins. diameter. (Courtesy, Harco Industries, Inc., U.S.A.)

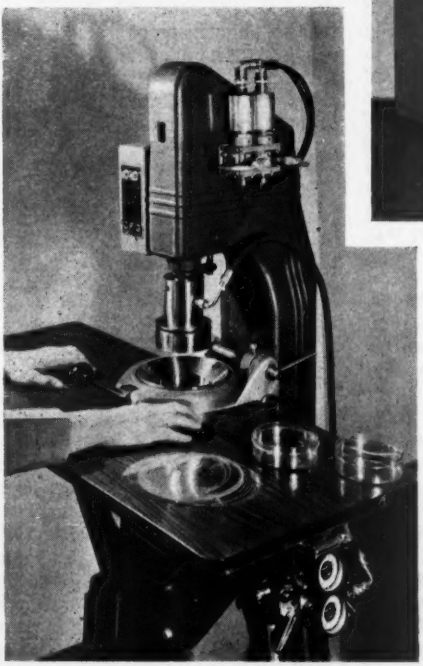


Fig. 13 (left).—Close-up of drawing machine for containers to 4 ins. diameter. (Courtesy, Taber Instrument Co., Inc., U.S.A.)

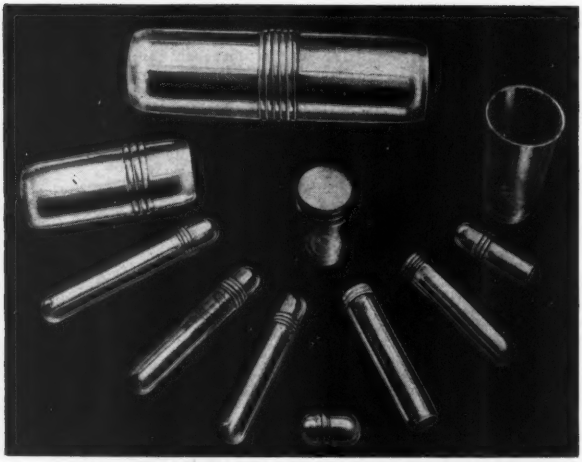


Fig. 15.—Examples of seamless transparent cellulose acetate containers. (Courtesy, Utilex Ltd.)

method is the slow production rate and the large quantities of solvent used involving expensive recovery equipment. On the other hand, it is difficult to envisage another method of production for tubular containers of the type illustrated, or indeed, for any very deep seamless container. A recent addition to the method of making seamless containers is to extrude transparent acetate tubing followed by cutting it off at the required length and beading, threading, etc., as before.

Lids and Bases for Transparent Containers

Mention of the beading technique for transparent cylindrical containers has already been made, but in some cases, particularly with small-diameter containers, the cap and base are screw-threaded. This is carried out by special hot moulding techniques.

Some examples of threaded seamless containers in transparent cellulose acetate are illustrated in Fig. 15.

In addition to card and plastic lids and bases, metal (tin plate) lids are often used in conjunction with a headed top container to give the necessary rigidity. Also all-metal bases are often crimped on to the cemented cylinder, a common type of container being a transparent cellulose acetate cylinder beaded along the top circumference, with a coloured tin-plate base crimped on as with an ordinary metal can and with a metal slip-on lid.

This point is emphasized in order to bring out the fact that a large percentage of cellulose acetate containers made to-day are not all transparent plastic, but a combination of plastic with metal and/or card.

(To be continued)

Copolymerization Researches

A critical discussion of the mechanism of formation of copolymers by addition polymerization is presented in a recent work by R. Simka and L. A. Wall, who deal mainly with such fundamental aspects as quantitative treatment of reaction, methods for analysis of copolymer compositions, experimental results interpreted on basis of resonance and of electro-static and steric effects. ("J. Research Nat. Bureau of Standards," 1948/41/521.)

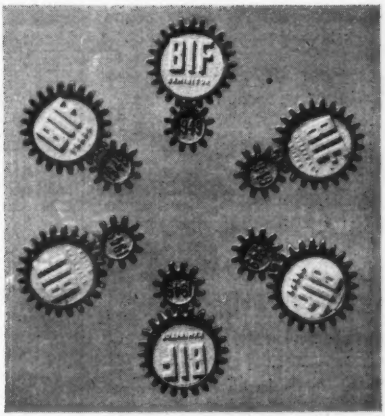
British Industries Fair

Preview of Plastics Exhibits

THE third post-war British Industries Fair will open in London and Birmingham on May 2, continuing until May 13. As last year, the Plastics Section will again be on the first floor at Earls Court, but several exhibitors previously at Earls Court are this year to be found only at Birmingham or have otherwise transferred to Olympia.

The number of exhibitors in the Plastics Section this year is 49; last year it was 67, showing that certain 1948 exhibitors are not again represented; but the omissions do not include names which have for long been associated with the plastics industry, and where these are not actually in the Plastics Section they may be elsewhere at the Fair. To offset any suggested reduction in the number of plastics exhibitors, it is to be observed that there are 10 new names which have not previously exhibited in the Plastics Section, and to these must be added another eight names which are located elsewhere at Earls Court, mainly in the sections devoted to furniture, textiles and "leather" goods.

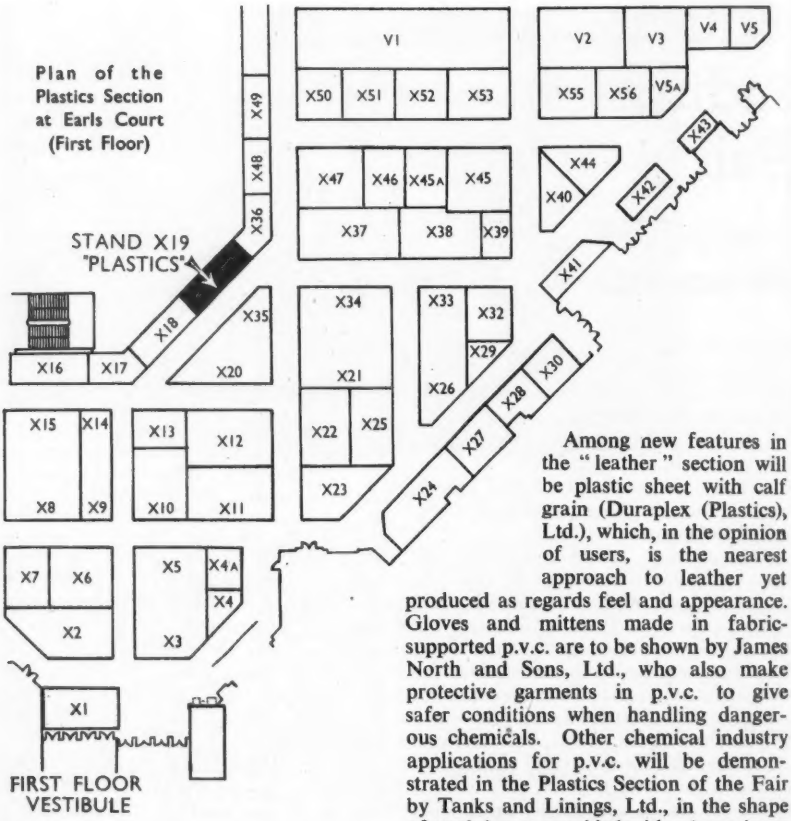
Altogether, there are 63 exhibitors at Earls Court, and between 30 and 40 at Olympia, who will be showing raw materials for moulding, semi-finished products and the end-products of the plastics industry. To assist visitors to the Fair, we give on these pages an analytical bird's eye view of the range of exhibits, and also a plan for the easier location of any particular stand in the Plastics Section.



The 1949 B.I.F. Admittance Badge takes a new form symbolizing industry. (Mouldings by Fraser and Glass Ltd.)

This year we have included a note of the production of film; also of the exhibitors of fabric-backed p.v.c. leathercloths. The latter in a variety of leather grains and other embossed designs promise to be widely adopted for upholstery and in the making of travel goods. Included here are imitation reptile grains in two- and three-tone effects, which are seen for the first time.

Among productions to be shown at this year's Fair for the first time will be a new type of plastic sheeting ("Fromocene") which is not affected by cold at any temperature to be met under normal conditions (Wallington, Weston and Co., Ltd.); woven p.v.c. webbings, both rigid and soft type, for chairs, belts, braces, etc. (Clutson and Kemp, Ltd.); welded tubes made from "acrylic" sheet, now finding various industrial uses (Evolite Plastics, Ltd.); frozen food "conservators" constructed in insulating laminates, textile loom accessories in high-density "Jabroc" impregnated wood, and fish-plates in similar materials as used by the Signals Section of British Railways (Moulded Components (Jablo), Ltd.); complete "Perspex" interior linings, door linings and surrounds for refrigerators, and swinging



advertising signs for shops (Thermo-Plastics, Ltd.); and a range of woven glass fabrics, including "loomstate" for laminates, plastic-coated glass-cloth and glass-fabric backed p.v.c. leathercloth (The Marglass Co.).

Two entirely new types of material, as well as interesting furniture designs, based on laminates, are to be shown by Warerite, Ltd. "Warerite Stroke 4" is a surfacing material of exceptional hardness; a new linen pattern material is known as "Warerite Weave." Real wood veneers and the original designs of artists can be incorporated in these plastics, and examples are to be exhibited.

Among new features in the "leather" section will be plastic sheet with calf grain (Duraplex (Plastics), Ltd.), which, in the opinion of users, is the nearest approach to leather yet produced as regards feel and appearance. Gloves and mittens made in fabric-supported p.v.c. are to be shown by James North and Sons, Ltd., who also make protective garments in p.v.c. to give safer conditions when handling dangerous chemicals. Other chemical industry applications for p.v.c. will be demonstrated in the Plastics Section of the Fair by Tanks and Linings, Ltd., in the shape of steel drums provided with a loose inner bag made from plasticized p.v.c. sheet (for transport of chemicals) and ducking of unplasticized p.v.c.

Small quantities of Erinoid polystyrene from the pilot plant of the joint undertaking between Petrochemicals, Ltd., and Erinoid, Ltd., will be seen at the Erinoid stand, as also p.v.c. in all forms, with particular prominence given to the range of extrusions in this material, both flexible and rigid.

A new development to be shown by I.C.I. is polytetrafluorethylene, which their plastics division is now manufacturing under the name of "Fluon." This unique new plastic has many outstand-

Table 1.—Summary of Plastics Exhibits at Earls Court

Exhibitor	Stand No.	Raw Materials for Moulding: Casein	Phenolics	Urea and/or Melamine	Cellulose Plastics	Vinyl (incl. polystyrene)	Polythene	Acrylics	Finished or Semi-finished: Mouldings	Extrusions	Laminates	P.V.C. Sheet	P.V.C. Leathercloth	Film	Fabrication from Acrylic or Acetate Sheet
Arlington Plastics Development Ltd.	X27	—	—	—	—	—	—	—	—	—	—	—	X	—	—
Amoride Ltd.	R99	—	—	—	—	—	—	—	—	—	—	X	X	—	—
BX Plastics Ltd.	X8, X15	X	—	—	X	X	—	—	—	X	—	X	—	X	—
Beetle Products Co. Ltd.	X26	—	—	X	—	—	—	—	—	—	—	—	—	—	—
British Artid Plastics Ltd.	X55	—	—	—	—	—	—	—	X	—	—	—	—	—	—
British Celanese Ltd.	X20, X35	—	—	—	X	—	—	—	—	X	X	—	—	X	—
British Ebonite Co. Ltd.	X29	—	—	—	—	—	—	—	X	X	—	—	—	—	—
British Geon Ltd.	X11	—	—	—	—	X	—	—	—	—	—	—	—	—	—
British Industrial Plastics Ltd.	X33	—	—	X	—	—	—	—	X	—	—	—	—	—	—
British Moulded Plastics Ltd.	X45	—	—	—	—	—	—	—	X	—	—	—	—	—	—
British Resin Products Ltd.	X12	—	X	X	X	—	—	—	—	X	—	—	—	—	—
Cascelloid Ltd.	X32	—	—	—	—	—	—	—	X	X	—	—	—	—	X
Clutsom and Kemp Ltd.	Q312	—	—	—	—	—	—	—	—	X	—	—	—	—	—
E. K. Cole Ltd.	X53	—	—	—	—	—	—	—	X	—	—	—	—	—	—
Commercial Plastics Ltd.	X4a	—	—	—	—	—	—	—	X	X	—	X	X	X	—
P. B. Cow and Co. Ltd.	X44, Q145	—	—	—	—	—	—	—	X	—	—	X	—	—	—
Cromwells Ltd.	V1	—	—	—	—	—	—	—	X	—	X	—	—	—	—
Crystalate Ltd.	X37	—	—	—	—	—	—	—	X	—	—	—	—	—	—
De La Rue Insulation Ltd. and De La Rue Extrusions Ltd.	X2	—	—	—	—	—	—	—	—	X	X	—	—	—	—
Dermide Ltd.	R104	—	—	—	—	—	—	—	—	—	—	—	X	—	—
Dufay-Chromex Ltd.	X9, X14	—	—	—	X	—	—	—	—	—	—	—	—	X	X
Duraplex (Plastics) Ltd.	X13	—	—	—	—	—	—	—	—	—	—	—	X	—	—
Duratube and Wire Ltd.	X1	—	—	—	—	—	—	—	—	X	—	—	—	—	—
Ebonestos Industries Ltd.	X37	—	—	—	—	—	—	—	X	—	X	—	—	—	—
Erinoid Ltd.	X3, X5	X	—	—	X	X	—	—	—	X	—	X	—	—	—
Evolite Plastics Ltd.	X49	—	—	—	—	—	—	—	—	—	—	—	—	—	X
Fraser and Glass Ltd.	X50	—	—	—	—	—	—	—	X	—	—	—	—	—	—
Greenwich Leathercloth Co. Ltd.	X6	—	—	—	—	—	—	—	—	X	—	X	X	X	—
Harris and Sheldon Ltd.	Q519	—	—	—	—	—	—	—	—	—	—	—	—	—	X
Hill, Norman and Beard Plastics Ltd.	V4	—	—	—	—	—	—	—	—	—	X	—	—	—	—
Holoplast Ltd.	X23	—	—	—	—	—	—	—	—	—	X	—	—	—	—
Hornflowa Ltd.	X52	—	—	X	X	X	—	—	X	—	—	—	—	—	—
Hupfield Brothers Ltd.	X42	—	—	—	—	Injection Moulding Machines			—	—	—	—	—	—	—
I.C.I. Ltd. (Plastics Division)	X21, X34	—	X	X	—	X	X	X	—	X	—	X	—	X	—
Insulators Ltd.	Q47	—	—	—	—	—	—	—	X	—	—	—	—	—	—
Kenverne Ltd.	Q717	—	—	—	—	—	—	—	—	—	—	X	—	—	—
Leather Cloth Co. Ltd.	R98	—	—	—	—	—	—	—	—	—	—	—	X	—	—
Leicester Lovell and Co. Ltd.	X31	—	—	—	Synthetic glues				—	—	—	—	—	—	—
McGavigans Ltd.	P13	—	—	—	—	—	—	—	—	—	—	—	—	—	X
Marglass Co.	Q78	—	—	—	—	—	—	—	—	—	—	—	X	—	—
C. and C. Marshall Ltd.	X7	—	—	—	—	—	—	—	—	X	—	—	—	—	—
Mentmore Manufacturing Co. Ltd.	X46	—	—	—	—	—	—	—	X	—	—	—	—	—	—
Mica Products Ltd.	X37	—	—	—	—	—	—	—	X	—	X	—	—	—	X
Moulded Components (Jablo) Ltd.	X43	—	—	—	—	—	—	—	—	—	X	—	—	—	—
Moulded Products Ltd.	X45	—	—	—	—	—	—	—	X	—	—	—	—	—	—
G. Read and Co. (Hackney) Ltd.	X56	—	—	—	—	—	—	—	X	—	—	—	—	—	—
Stanley Smith and Co.	X36	—	—	—	—	—	—	—	—	X	—	X	—	—	—
Souplex Ltd.	X30	—	—	—	—	—	—	—	X	—	—	—	—	—	—
Sterling Moulding Materials Ltd.	X16	—	X	—	X	X	—	—	—	—	—	—	—	—	—
Stone and Simmons	X41	—	—	—	—	—	—	—	X	—	—	—	—	—	—
Storey Brothers and Co. Ltd.	R100	—	—	—	—	—	—	—	—	—	—	X	X	X	—
Streetly Manufacturing Co. Ltd.	X38	—	—	—	—	—	—	—	X	—	—	—	—	—	—
Tanks and Linings Ltd.	X139	—	—	—	—	—	—	—	X	X	X	X	—	X	—
Thermo-Plastics Ltd.	X51	—	—	—	—	—	—	—	X	—	X	—	—	—	X
Triplex Safety Glass Co. Ltd.	X40	—	—	—	—	—	—	—	X	—	—	—	—	—	X
Universal Plastics Ltd.	X48	—	—	—	—	—	—	—	X	—	—	—	—	—	—
Utilex Ltd.	X3, X5	—	—	—	—	—	—	—	—	—	—	—	—	X	X
Vinyl Products Ltd.	X25	—	—	—	—	X	—	—	—	—	—	X	—	—	—
Wallington, Weston and Co. Ltd.	X10	—	—	—	—	X	—	—	—	—	—	X	—	—	—
Bernard Wardle and Co. Ltd.	X24	—	—	—	—	—	—	—	—	—	—	—	X	—	—
Warerite Ltd.	V71	—	—	—	—	—	—	—	—	—	X	—	—	—	—
Jas. Williamson Ltd.	V41	—	—	—	—	—	—	—	—	—	—	—	X	—	—

ing properties. In particular, it possesses extrême chemical inertness and solvent-resistance, excellent electrical properties, and good mechanical properties at high temperature. Articles made from "Fluon" can often be used over a wider temperature range than can other plastics. "Fluon" remains flexible down to temperatures of about −70 degrees C., and does not melt below 327 degrees C. Samples of "Fluon," in the form of a fibrous white powder, and specimens of various types of industrial mouldings will be displayed.

Another I.C.I. exhibit illustrates the possibilities of "Alkathene" film for packaging. The flexibility and toughness of this material at low temperatures make it particularly suitable for the packaging of frozen foods. Some examples of applications in this field will be seen in a refrigerator display cabinet.

A shock moulding unit will demonstrate the shock-moulding process with "Perspex" acrylic sheet. Using metal tools and an ordinary compression-moulding press, this technique produces a high output of accurate "Perspex" mouldings, such as bulkhead lights and sturdily designed lighting units for lighthouses.

As large manufacturers of vinyl raw materials, synthesized in their chemical plant at Barry, South Wales, British Geon, Ltd., are endeavouring to tell the story of vinyls and show how wide is their range of usefulness.

This year's display by BX Plastics, Ltd., will be raw materials in great predominance. They will be showing a complete range of their materials in sheet, rod, tube, powders and paste, and as specially designed extrusions, covering cellulose acetate, polyvinyl chloride, casein, polystyrene and ethyl cellulose. There will be special emphasis on "Bexan" monofilaments and p.v.c. in new forms.

The display of cellulose acetate plastics by British Celanese, Ltd., will comprise "Celastoid" extruded tubing, rods and sections, foil for transparent packaging, sheeting and moulding powders. A significant advance is the development of "Celastoid" tubing up to 3 ins. outside diameter. Its versatility will suggest original themes and uses in many fields, one recent development being as a covering for light metal or wood.

By improved production methods, transparent foil of crystal-clear transparency which does not dry or embrittle with age is now manufactured in reels of 44 ins. width, in a range of thicknesses from 1/1,000 in. to 5/1,000 in. This "Clarifoil" is an ideal material for all varieties of foil packs, for wrappings over merchandise or over tin box containers, or for use in the manufacture of window-type containers. Laminates introduce an even wider range of specialized applications, examples being laminations to metal foil for hygienic bottle caps or pharmaceutical products, to glassine for confectionery and grocery wrappings, and to paper for book jackets and magazine covers. A recent development of "Clarifoil" is the technique of spiral winding capable of production in a variety of sizes, suggesting packaging for tooth brushes, knitting wool, shaving brushes and soap, and other goods.

Utilex, Ltd., will show cellulose acetate film, and rigid transparent containers in cellulose acetate, seamed and seamless.

A large selection of moulded articles made from urea and melamine moulding powders will be exhibited by the Beetle Products Co., Ltd., including "Beetle" plasticized moulding powder, which is now in very much freer supply. Textiles treated with "Beetle" textile resins, applications of coating resins, core-binding resins for the foundry trade, and cements for the manufacture of wall-boards and flooring blocks and boards from wood-waste will provide separate displays. The high wet strength of papers treated with "Beetle" paper resins will also receive demonstration.

Crystalate, Ltd., and Ebonestos Industries, Ltd., are showing a wide range of moulded, fabricated and machined components for practically every industry of

Table 2.—Mouldings, Extrusions and Certain End Uses Exhibited at Earls Court.

Exhibitor	Stand No.	Electrical Industry	Radio Cabinets	Engineering Components	Motorcar/ Aircraft	Builders' Hardware	Building Materials/ Sanitary Fittings	Furniture	Soft Furnishings/ Upholstery	Domestic Ware	Travel Goods	Toys	Hard Haberdashery/ Fancy Goods
Arlington Plastics Development Ltd.	X27	—	—	—	—	—	—	—	X	—	X	—	—
Armoride Ltd.	Q524	—	—	—	—	—	—	—	X	—	X	—	—
British Artid Plastics Ltd.	X55	—	—	—	—	—	—	—	—	X	—	—	X
British Celanese Ltd.	X20 X35	Cellulose Acetate Film and Containers											
British Ebonite Co. Ltd.	X29	X	—	X	—	—	—	—	—	—	—	—	—
British Geon Ltd.	X11	X	—	X	—	—	—	—	X	—	—	—	—
British Moulded Plastics Ltd.	X45	X	X	X	X	—	—	—	—	X	—	—	—
Cascelloid Ltd.	X32	X	—	—	—	—	—	—	—	X	—	X	X
Clutsom and Kemp Ltd.	Q312	—	—	—	—	—	—	—	X	—	—	—	—
E. K. Cole Ltd.	X53	X	X	X	—	—	—	—	—	—	—	—	—
Commercial Plastics Ltd.	X4a	—	—	—	—	—	—	—	X	—	—	—	—
P. B. Cow and Co. Ltd.	X44	—	—	—	—	—	—	—	X	X	X	X	X
Crystalate Ltd.	X37	X	X	X	X	X	—	—	—	X	—	X	X
De La Rue Insulations Ltd.	X2	X	—	X	—	—	X	—	—	—	—	—	—
Dermide Ltd.	R104	—	—	—	—	—	—	—	X	—	—	—	—
Dufay-Chromex Ltd.	X9 X14	—	—	—	X	X	—	X	—	—	X	X	—
		Cellulose Acetate Film and Containers											
Duraplex (Plastics) Ltd.	X13	—	—	—	—	—	—	—	X	—	X	—	—
Duratube and Wire Ltd.	X4	X	—	—	—	—	—	—	—	—	—	—	—
Ebonestos Industries Ltd.	X37	X	—	X	X	X	—	X	—	X	—	X	—
Erinoid Ltd.	X3 X5	—	—	—	X	X	—	—	X	—	—	—	X
Fraser and Glass Ltd.	X50	X	X	X	—	—	—	—	—	—	—	X	—
Greenwich Leathercloth Co. Ltd.	X6	—	—	—	—	—	—	—	X	—	X	—	—
Hill, Norman and Beard Plastics Ltd.	V4	—	—	—	—	—	—	X	—	—	—	—	—
Holoplast Ltd.	X23	—	—	—	X	—	X	X	—	—	—	—	—
Hornflowa Ltd.	X52	—	—	—	—	—	—	—	—	—	—	—	X
Insulators Ltd.	X47	X	X	X	X	—	—	—	—	X	—	—	—
Kenverne Ltd.	Q717	—	—	—	—	—	—	—	—	—	—	X	—
Leather Cloth Co. Ltd.	R99	—	—	—	—	—	—	—	X	—	X	—	—
Marglass Co.	Q718	X	—	—	X	—	—	—	X	—	X	—	—
C. and C. Marshall Ltd.	X7	—	X	—	—	—	—	—	X	—	X	X	X
Mentmore Manufacturing Co. Ltd.	X46	X	X	X	X	X	—	—	—	X	X	X	—
Mica Products Ltd.	X37	X	—	X	X	—	—	—	—	X	—	X	—
Moulded Components (Jablo) Ltd.	X43	X	—	X	X	X	X	—	—	—	—	—	—
Moulded Products Ltd.	X45	X	—	X	—	—	—	—	—	—	—	—	—
G. Read and Co. (Hackney) Ltd.	X56	X	—	—	—	—	—	—	—	X	—	X	—
Stanley Smith and Co.	X36	—	—	—	—	—	—	—	X	—	—	—	—
Souplex Ltd.	X43	X	—	X	—	—	—	—	—	—	X	—	—
Stone and Simmons	X41	—	—	—	—	—	X	—	—	X	—	—	—
Storey Brothers and Co. Ltd.	R100	—	—	—	—	—	—	—	X	—	—	—	—
Streetly Manufacturing Co. Ltd.	X38	X	X	—	—	—	—	—	—	X	—	—	—
Thermo-Plastics Ltd.	X51	X	X	X	X	—	X	—	—	X	X	—	—
Triplex Safety Glass Co. Ltd.	X40	X	—	X	X	—	X	—	—	X	—	—	—
Universal Plastics Ltd.	X48	X	X	—	—	—	—	—	—	X	—	X	X
Utilex Ltd.	X3 X5	Cellulose Acetate Film and Containers											
Vinyl Products Ltd.	X25	—	—	—	—	—	—	—	X	—	—	—	—
Wallington, Weston and Co. Ltd.	X10	—	—	—	X	—	X	—	X	—	—	X	—
Bernard Wardle and Co. Ltd.	X24	—	—	—	—	—	—	—	X	—	—	—	—
Warerite Ltd.	V71	—	—	—	—	—	—	X	—	—	—	—	—
Jas. Williamson Ltd.	V41	—	—	—	—	—	—	—	X	—	—	—	—

importance will stress the fact that these concerns have been established for 50 years in the plastics industry. Their associated company, Mica Products, will be exhibiting injection mouldings in thermoplastics, together with paper and fabric base tubes and rods for the electrical and radio industries, machinings and stampings from laminated sheet, rods, bobbins and formers, fabrications in "Perspex," and mica insulation components.

The Streetly Manufacturing Co., Ltd., will be showing selected mouldings in urea, melamine, phenolic and thermoplastic materials, ranging in size from small tube caps to radio cabinets. "Case-histories" of some of the most interesting

Table 3.—Summary of Plastics Exhibits at Olympia

Exhibitor	Stand No.	Electrical Industry	Engineering Components	Motorcar/ Aircraft	Builders' Hardware	Soft Furnishings	Domestic Ware	Travel Goods	Toys	Hard Haberdashery/ Fancy Goods	Religious Ornament
Aberdeen Combworks Co. Ltd.	K121	—	—	—	X	—	—	—	—	X	—
Airfix Products Ltd.	N26b	—	—	—	—	—	X	—	X	X	—
W. H. Bossons	K31	—	—	—	—	—	—	—	—	—	X
Casclloid Ltd.	N103	X	—	—	—	—	—	—	X	X	—
P. B. Cow and Co. Ltd.	N2	—	—	—	—	X	—	X	X	—	—
Crayonne Ltd.	K64	X	—	—	—	—	—	—	—	X	—
John Dickinson and Co. Ltd.	M46	—	—	—	—	—	X	—	—	—	—
E.V.B. Plastics Ltd.	N58	—	—	—	—	—	—	—	X	—	—
Fairylite Moulded Plastics Ltd.	N106	—	—	—	—	—	—	—	X	—	—
H. J. Gordon and Sons Ltd.	K2a	—	—	—	—	—	X	—	—	X	—
E. R. Holloway Ltd.	K85	—	—	—	—	—	—	—	—	X	—
Jarvis, Son and Glossop Ltd.	H652	—	—	—	—	—	X	—	—	—	—
Wm. Jones, Clifton and Co. Ltd.	M115	X	—	X	—	—	—	—	—	—	—
Kasinoid Ltd.	K64	—	—	—	—	—	—	—	—	X	—
Klampshayd Co. Ltd.	K118	X	—	—	—	—	X	—	—	X	—
O. and M. Kleemann Ltd.	K108	—	—	—	—	—	—	—	X	X	—
Mendle Bros. Ltd.	K1a	—	—	—	—	—	X	—	—	—	—
Mitchell Plastics Ltd.	N26a	—	X	—	X	—	—	—	X	—	—
Plastic Fashions Ltd.	K91	—	—	—	—	—	—	—	X	X	—
Rosedale Associated Manufacturers Ltd.	N110	—	—	—	—	—	X	—	X	—	—
"Seaforth"	K87	—	—	—	—	—	X	—	X	X	—
P. Sedley	N67	—	—	—	—	—	X	—	X	—	—
E. Shipton and Co. Ltd.	E56	X	X	—	—	—	—	—	—	—	—
Stadium Ltd.	K126	—	—	—	X	—	X	—	—	X	—
Strong and Co.	K61	—	—	—	—	—	X	—	—	X	—
Suflex Ltd.	G25	X	—	—	—	—	—	—	—	—	—
Twinco Ltd.	K94	—	—	—	—	—	X	—	—	X	—
Viscose Development Co. Ltd.	D19	X	—	—	X	—	X	—	—	—	—
J. M. Welter Ltd.	K1a	—	—	—	—	—	X	—	—	—	—
Warm-Glow Co. Ltd.	C125	—	—	—	—	X	—	—	—	—	—

mouldings will indicate the development of the form of moulding from the original idea.

New products and developments will be shown for the first time by De La Rue Insulation, Ltd. These will comprise a plastic floor covering produced by their associated company, De La Rue Floors and Furnishings, Ltd., and a large internaminate printed mural in non-scratch, non-stain, "Formica."

Hot-melt compounds, suitable for casting concrete, will be featured by Vinyl Products, Ltd., who will also show for the first time hot-dip protective coatings based on indigenous materials, and butyl methacrylate emulsions for leather and textile finishing.

An all-plastic kitchen for a luxurious caravan will be featured by Triplex Safety Glass Co., Ltd.; a ship's cabin furnished in p.v.c. leathercloth, by Jas. Williamson and Son, Ltd.; constructional work utilizing "Holoplast" by Holoplast, Ltd.

One exhibitor in the Plastics Section at Earls Court (Hupfield Bros., Ltd.), will be showing for the first time their injection moulding machine, and also a plastics granulating machine. The main display of plastics machinery, however, will be seen at Birmingham.

Plastics Exhibits at Olympia

Plastics exhibits at Olympia are conveniently analysed in one of our tabulated summaries. These fall mainly under the heading of toys, hard haberdashery such as combs, domestic ware, fancy goods, etc. One exhibitor (E. Shipton and Co., Ltd.) will show the application of polythene to the unbreakable streamlined housing of their "Intercall" telephone; another (Suflex, Ltd.) will show extruded p.v.c. sleevings for electrical uses.

Exhibits at Birmingham

In the Engineering Section of the Fair at Castle Bromwich, Birmingham, exhibitors of presses and/or injection moulding machines include Bradley and Turton, Ltd., T. H. and J. Daniels, Ltd., E.M.B. Co., Ltd., Finney Presses, Ltd., Alfred Herbert, Ltd., Projectile and Engineering Co., Ltd., Turner Manufacturing Co., Ltd., R. H. Windsor, Ltd., and Foster, Yates and Thom, Ltd. There will be a special display of moulding tools by B.I.P. Tools, Ltd. Tipped tools will be featured by A. C. Wickman, Ltd., and Protolite, Ltd. Radio-frequency heaters and welders will be shown by Delapena and Son, Ltd., E.M.I. Factories, Ltd., and Radio Heaters, Ltd. A working demonstration of the flame spraying of polythene and related material will be given by Schori Metallising Process, Ltd.

Moulding powders, laminates and "Vybak" cable coverings are to be featured by Bakelite, Ltd. The general theme of the display is to show the ways in which the company's materials are increasing productivity in other industries. Examples from the textile industry will include moulded spinning pots and thread advancing reels, pulleys, and bobbins, which are all capable of withstanding conditions of extreme humidity, exposure to acids and alkalis, and continuous immersion in water. The advantages of "Vybak" cable-covering compounds for electric wire and cable insulation will stress the fact that this material does not attack the copper conductor.

Synthetic resin bonded laminates in sheet and tube forms, in paper base for electrical insulations, and in fabric base for electrical and mechanical applications, including silent gears, heavy-duty bearings and pump rings will be exhibited by Ioco, Ltd. At this stand will also be seen "Silopex" woven glass fabric impregnated with silicone varnish for electrical insulations where resistance to temperature in excess of 200 degrees C. is required.

Exhibits by Beetle Bond, Ltd., will demonstrate the strength, durability and water-resistant properties of "Beetle" adhesives. A small press will be installed on the stand and joints are to be made at visitors' requests. Although devoted mainly to building applications, there will also be an exhibit on this stand of foundry sand cores bonded with resins.

Birkbys, Ltd., will be showing phenolic moulding material and a range of mouldings for the electrical, engineering, motor-car, aircraft and other industries. British Moulded Plastics, Ltd., and Moulded Products, Ltd., whose main exhibits are in the Plastics Section at Earls Court, London, also have stands at Birmingham. Evered and Co., Ltd., as on former occasions, will show mouldings for builders' and cabinet makers' use, and as architectural adornment. Lacrinoid Products, Ltd., exhibit door furniture, as well as buttons, buckles and fancy goods. Lavatory cisterns with non-corroding frost-resisting plastic shells will be seen at the stand of Shires and Co. (London), Ltd. Resin-bonded quilt for thermal insulation and sleevings for electrical insulation are to be featured by Fibreglass, Ltd.

Laminated plastic tubes and stampings will form part of the display of essential components for the radio and electrical industries by Langley London, Ltd.

Developments in Tools

Two new developments by B.I.P. Tools, Ltd., will be on show for the first time; both are outstanding in importance to moulders and mould makers. The first is the fitting of induction heating coils in plastic moulding tools, a method offering the advantages of quicker heating-up, improved consistency of temperature, more robust construction, and greater reliability. The second innovation is the precision casting of moulds and mould parts. This not only allows the mould maker a much wider choice of materials, but it is possible for a wealth of fine details to be duplicated accurately any number of times. Accuracy of detail and quality of surface minimize the work required for finishing the mould.

International Plastics

Following the meeting of the Journees Internationale des Plastiques held in January in Paris, we have much pleasure in abstracting two of the papers herewith. Abstracts of others by French and British contributors will be published in subsequent issues of this journal.

New Sources of Raw Materials for the British Plastics Industry

By M. D. CURWEN.

THE British chemical industry has been working in a groove for more than 100 years, during which time it has depended almost entirely on coal and on the products derived from it. It is true that, up to about 20 years ago, there was quite a thriving wood-distillation industry which provided methyl alcohol (and therefore formaldehyde), acetic acid, acetic anhydride and several other compounds. Between two wars, with the growth of alcohol oxidation processes, of synthetic methanol and cheap acetic acid and other derivatives from Canada and the U.S.A., many of these factories were forced to shut down.

As I have indicated, the chemical industry of Great Britain has revolved almost entirely around coal. After 1918, Great Britain had determined to produce most of its own dyestuffs and pharmaceuticals and, indeed, by 1930 had succeeded in producing over 95 per cent. of its needs of the former. Since those days, a host of new well-known products in the above ranges and new agricultural chemicals, from the specific weed killers to locust eradicators, have been produced, almost all from coal tar ring compounds.

Nor need I relate to you in detail the growth of the modern plastics industry, of the production of phenolics, or urea resins, of the acrylics and polystyrene compounds, of the vast range of plasticizers, polymerizing agents and inhibitors, which also mainly depend on phthalates and phthalic anhydride (and therefore from naphthalene), cresylic acids, aryl peroxides, quinones, etc. Within the last 5 or 10 years the thermoplastics polyvinyl chloride, polyvinylidene chloride and co-polymers have all joined the throng, all, in Great Britain, drawing quotas of materials from coal. To cap it all, vast factories have been working for the past five years in the production of nylon, both raw materials, adipic acid and hexamethylenediamine, being produced from phenol.

So much for the past, or rather the history to date. What of the future? There is little doubt that the demand for all these plastics derived from coal will increase. Moreover, new plastics are on their way.

One of the most interesting of these is Terylene, a substance produced by the interaction of terephthalic acid and glycerine and is therefore of the alkyd type of resin. It was discovered by Calico Printers Association and is being technically developed by Imperial Chemical Industries, Ltd., as a synthetic fibre, comparing very favourably with nylon. But, here again, since terephthalic acid is made from *p*-xylene we are still in the field of coal distillation. Similarly, we have the resorcinol resins, the production of which is slowly increasing.

What other raw materials can we use to relieve the situation, especially in the face of the recent decision by the British Government to spend £100,000,000 in expanding the chemical industry alone, and to expand also the plastics industry?

Obviously we must still look to coal as our largest source of phenols and other products. But, obviously, we must look elsewhere for help.

We had at one time hopes of a little help in the production of synthetic-resin powders from the natural phenols, such as quebracho and mimosa, which were, in fact, examined successfully during the war. Unfortunately, there is a world shortage of tanning materials and these natural tannins are being retained for

producing leather; this source must be closed until the distant future.

Perhaps one of the more important, and certainly interesting, raw materials for plastics may yet be the proteins.

While the horn-fabricating industry has existed in this country, and in Europe generally, for at least 1,000 years, and seems largely to have disappeared, yet there is some rebirth in the production of more or less pure keratin for use as such, or by admixture with urea-formaldehyde to form moulding powders for the production of buttons simulating genuine horn.

What is of more direct interest in the protein field is the proposed large-scale use of groundnut protein obtained from the meal, after the extraction of the oil for food purposes, and the production therefrom of a fibre called "Ardil."

It is certainly true that many other of the natural proteins are valuable as fibres or glues. The use of casein has long been known, but keratin and proteins in hair, feathers and egg waste have all been examined with promising results.

The main point of this paper, however, does not concern these materials in any important degree, however great their future may be.

By a fortuitous chain of circumstances, three British concerns and, to a small extent, one American company with works in Great Britain, have decided, more or less at the same period, to launch similar projects which will relieve the situation. We are in the process of reorientating our supplies of intermediate chemicals for the plastics industry by creating new petroleum industries.

I should like you to recall, among the simple things you have learned in your organic chemical lessons, that it is possible to break down ring compounds to straight-chain compounds, and that, vice versa, it has also long been known that it is possible to make ring compounds from straight-chain compounds. Before the 1940s the need of doing either had never arisen; now both are necessary.

Thus we come to Great Britain's forthcoming experiment. At least four great refineries are to be built, three of them utilizing processes on more or less conventional lines, producing by cracking a variety of unsaturated gases. The Shell Company will produce acetone, diacetone alcohol, isopropyl alcohol, mesityl oxide and diallyl phthalates, the last-named for laminating, casting and tile resins. Imperial Chemical Industries, Ltd., will produce the cracked gases ethylene and propylene in large quantities, which will be used for polythene, isopropyl alcohol and acetone, sources also for methyl methacrylate and possibly, in the future, acrylonitrile and methyl acrylate.

In a different category is a refinery which is in process of erection by Manchester Oil Refineries, which we hope to see in actual production this year. Here, for the first time in the history of industrial endeavour, ring compounds will be made from straight-chain compounds on a very large scale.

The new plant will initially have a capacity of 50,000 tons per annum of charging stock and will be expanded eventually to 100,000 tons per annum.

The process is called the Catarole process which, by the catalytic action of aluminium oxide and promotors, such as chromium oxide, is able to transform aliphatic hydrocarbons present in petroleum into aromatics.

The process is extremely flexible and, as an example, can convert a petroleum heavy naphtha into about 50 per cent. by weight saturated and unsaturated gases, and 50 per cent. of liquid aromatic compounds.

The type of product, especially amongst the aromatics, is a fascinating augury for the future. Of first importance are benzene, toluene, xylenes, naphthalene, alkyl naphthalenes, phenanthrene, fluorene, pyrene and chrysene, all of which may be obtained in pure grades by azeotropic or fractional distillation and crystallization.

Since in the same plant we shall also see the production of hydrogen, methane, ethylene, propylene, butenes and buta-

diene, we can visualize the enormous range of possible products. Most important of these at the moment is that of styrene, and therefore polystyrene from ethylene and benzene, or of isopropylbenzene from propylene.

From the gases themselves will also be produced glycol and glycol derivatives, isopropyl alcohol, acetone, etc.

Thus, for the first time, we shall have in Great Britain not only a new source of raw materials for the phenolic-formaldehyde series, other well-known plastics via benzene, and the already existing polymers from unsaturated gases, but also a new range of chemicals whose future can only be guessed at, but which we are sure to employ. At least when these refineries are working full out and the chemical and plastics industry is geared to it, we shall be in a comparatively happy position.

Manufacture of Phenolic Resins Directly From Phenol Tar Oils

By ROGER SENTZ, Chief of Research, Enterprises Albert Cochery.

The speaker first described the classical method of producing phenolic resins and the inherent technical and economic difficulties in producing phenol (a) synthetically from benzol and (b) by distillation from coal tar. The idea of producing the resins directly from coal tar or phenolic oils is by no means new, but most of the methods suggested, namely, of treating the "crude" oils directly with an excess of formaldehyde, result in a mixture of a series of resins, each with different rates of curing. In practice the result is a soft moulding.

On the other hand, if the slowly curing resins could be segregated, they can be transformed to the B stage and be sufficiently plastic to be moulded. Powders of sufficiently rapid curing rates are thus possible from the so-called slow-hardening resins. Obviously the key to the problem lies in the selection of the different phenols, and in order to accomplish the segregation it is only necessary to add the formaldehyde under such conditions that only the most reactive phenols are attacked at first to remove the product, and to repeat the action on the residual oil until the desired stage of removal of phenols is reached.

In one series of such separations seven distinct resins were produced, and were examined for time of hardening by maintaining them in an oven at 95 degrees C. The results were as follow:—

Resin No. 1	17 minutes
Resin No. 2	17 minutes
Resin No. 3	24 minutes
Resin No. 4	27 minutes
Resin No. 5	40 minutes
Resin No. 6	Over 1 hour
Resin No. 7	Over 1 hour

It was obvious, the author declared, that Nos. 1 and 2 and Nos. 3 and 4 could be grouped and separated together, and in practice only three separations are made, giving on a similar hardening test to the above:—

Resin No. 1	15 minutes
Resin No. 2	30 minutes
Resin No. 3	180 minutes

On transforming resins No. 1 and No. 2 into moulding powders, the rates of hardening are nearly equivalent to ordinary phenolic and cresylic moulding powders. The disadvantage of such a process up to this point lies in the fact that the resin still contains a small proportion of oil, which slows up hardening. The final procedure, as now carried out by the factory, is the entire removal of such oil under vacuum. Thus not only are a series of moulding powders produced, but also an effective range of laminating and impregnating resins and varnishes for decoration.

DE LA RUE EXTRUSIONS, LTD., announce that they are now exporting cellulose acetate butyrate to Denmark. Supplies were previously obtainable only from the United States. In the form of extruded tube and rod, cellulose acetate butyrate is used for the manufacture of fountain pen and propelling pencil barrels.

British Plastics Federation Spring Conference

WHEN Dr. F. M. Herzberg, Managing Director of Hornflowa, Ltd., went to the United States last year as a member of the delegation from this country to the Convention of the Society of the Plastics Industry of America, he conceived the idea of a reunion of the delegation in Cumberland in the spring. This came to fruition in the four days' Conference which has just been held at the Armathwaite Hall Hotel, Bassenthwaite Lake. It was organized by the North West Section of the Moulders Group of the British Plastics Federation, of which Mr. J. B. Fortune, M.Sc., M.I.Mech.E., is the chairman. It was the first Conference of its kind ever to be held by the plastics industry, and was attended by 69 representatives and their wives, not only from the North West Section but from all parts of the country.

Starting with an informal dinner on the Thursday evening after the party had assembled, the Friday morning was devoted to a visit to the factory of Hornflowa, Ltd., at the Solway Estate, Maryport. Amongst the items which attracted attention were the automatic machines designed, patented and manufactured by the company for trimming button edges. An improved model which the company intends to place on the market was being demonstrated for the first time on the occasion of the visit. Another innovation, which attracted great interest, was a new machine for the counting of buttons at high speed, based on measurement by photo-electric cells.

After lunch the party proceeded via Allonby and Silloth to the works of British Rayophane, Ltd., at Wigton, where they were welcomed by Mr. H. Lonsdale, Managing Director, and Messrs. M. F. Monbiot and E. R. Campbell, Directors.

On Friday evening the official Federation dinner was followed by a film show. Mr. J. G. Helps, Area General Manager of the National Coal Board, gave an account of the making of "The Cumberland Story," before it was displayed on the screen. This was followed by a film on the making of plastics called "The Shape of Things to Come."

Saturday started with a business session, and ended with a dinner and dance given by the directors and management of Hornflowa, Ltd., at Armathwaite Hall.

NOTES FROM SOUTH AFRICA

Holes Industrial Developments (Pty.), Ltd., P.O. Box 1498, Johannesburg, are producing metal-coated plastic tiles, which are coated with various metals including copper, brass, silver, zinc.

Union Plastics (Pty.), Ltd., P.O. Box 13, Alberton, Transvaal, are now manufacturing "acrylic" sanitary-ware, including babies' baths, commodes, lavatory seats, hand basins, kitchen sinks and splashboards, display fittings and fluorescent light tubes, under the brand name of "Unipex."

Plastic dolls and toys are being made by a new South African firm, Alvarez Products (Pty.), Ltd., 47, De Villiers Street, Cape Town. The manufacturers claim that the dolls cannot be broken. They are being sold under the brand name, "Silkbabes."

Brushware Manufacturers (Pty.), Ltd., 48, Nursery Road, Fordsburg, Johannesburg, are now using plastics for brush backs and other parts which were formerly made in other materials. It has been found that plastics are cheaper than other materials, and at the same time they make a superior product.

African Plastic Industries (Pty.), Ltd., P.O. Box 1,113, Johannesburg, recently delivered a large consignment of plastic flower bowls. The bowls have been made in three separate parts, and polystyrene is being used for the outer and inner bowls. The heavy base is fitted with a large number of copper nails; as the flower stems are placed between these nails it is possible to set them at any angle. Polystyrene with fluorescent properties is used for the inner bowl; it gives a blue glow under sunlight or light from an electric lamp.

The building industry in South Africa is showing increasing interest in plastic wall tiles. The local plastics industry claims that tiles of this sort do not suffer from cracking or crazing; there is no risk of breakages during transport or laying, and cost of transport is much less than for other types of tiles.

New British Standards for Moulding Materials

THE first British Standard for "Polystyrene Moulding Materials" (B.S. 1493) has now been issued by the British Standards Institution under the authority of the Plastics Industry Standards Committee and of the Chemical Divisional Council.

Polystyrene

This new standard covers both general purpose moulding material and material suitable for electrical use. The requirements for both types of material cover screen analysis, percentage of methanol soluble matter, percentage of volatile matter, viscosity in benzene solution, impact strength and softening point. In the case of the material for electrical use, an additional requirement is that the power factor and permittivity of the material shall not exceed specified values when determined at a frequency of one megacycle per second by the Hartshorn and Ward method.

B.S.1493 differs in several respects from its A.S.T.M. equivalent and particularly in the addition of a test for volatile matter. This test has been included as there is some evidence to show that crazing in polystyrene mouldings may be controlled by a check on the amount of volatile matter present. Another point of difference is that the British method of determining softening point uses a very small test specimen which would be easier to mould and likely to be more free from internal strain than the relatively large A.S.T.M. specimen.

Phenolic Moulding Materials

A revision of B.S.771, "Synthetic Resin (Phenolic) Moulding Materials," has also just been published. This specification is of unusual interest, not only because of the wide use of phenolic moulding materials, but also because this British Standard is based on statistical principles. The reason for the adoption of this basis is the knowledge that little confidence can be placed in the results of tests on a small number of specimens made from a batch of materials, when these results are considered alone.

The revised standard relies on continual control of the product during manufacture. It defines basic values for the properties of phenolic moulding materials, and specifies the evidence which will be accepted as indicating conformity with those basic values. It may nevertheless be used for accepting or rejecting a single batch of moulding material, in any case when it is desired to do this.

The specification sets out mandatory requirements for the following properties of eight types of moulding materials: tensile strength, impact strength, surface resistivity, volume resistivity, heat resistance, power factor and permittivity. It also specifies optional requirements, any of which may be invoked by a purchaser, for water absorption, plastic yield, electric strength and acetone-soluble matter.

Cellulose Acetate

Another new Standard, B.S.1524, "Cellulose Acetate Moulding Materials," has the statistical basis already adopted for B.S.771, and for the same reason—the knowledge that, although it is impracticable to test more than a few specimens from each batch of moulding material, little confidence can be placed in the results of testing a few specimens.

Instead of the familiar requirement that "three specimens shall be tested of which not more than one shall fail," the new Standard defines basic values for the properties of cellulose acetate moulding materials and specifies the evidence which will be accepted as indicating conformity with those basic values. It does, in fact, require demonstration by manufacturers of the materials that the processes of manufacture have been controlled to secure a satisfactory product. Nevertheless, the Standard may be used for accepting or rejecting a single batch of moulding material in any case when it is desired to do this.

B.S.1524 specifies methods of test and qualifying requirements for the physical properties of three grades of material which are distinguished by different softening points. It also lays down further optional requirements for electric strength, fines and impurities, and colour bleeding, any of which may be invoked by a purchaser.

Copies of these British Standards may be obtained from the British Standards Institution, Sales Department, 24, Victoria Street, London, S.W.1, price 2s., 5s. and 3s. each respectively, post free.

Part of a mural by J. De Uzelai, illustrating the history of shipping over a thousand years, built into the Smoke Room of the Cunard White Star liner "Caronia." The design was reproduced entirely by hand on specially prepared paper, and incorporated as an integral part of the laminated plastics panels supplied by Warerite, Ltd.

Fig. 378A. (Mag. 20 diameters.)

Fig. 379A. (Mag. 90 diameters.)

Fig. 381A. (Mag. 90 diameters.)

Fig. 384A. (Mag. 90 diameters.)

Fig. 385A. (Mag. 700 diameters.)

Fig. 385B. (Mag. 700 diameters.)

Photomicrographs of sections of a wood flour filled phenolic moulding reproduced in their natural colours. The moulding was made in 1922.

The Microscopic Examination of Plastic Materials

VII.—Mouldings (Contd.)

By J. H. WREDDEN, F.R.M.S.
(Chief Chemist, Igranic Electric Co., Ltd.)

IN view of the information obtained by the examination of the wood flour filled moulding, as discussed in the last issue of "Plastics," it will be of interest to examine the sections of a moulding produced some 25 years ago.

The moulding which it is proposed to examine was made in 1922, and may be taken as representative of the high-quality materials of that time. It is made from a wood flour filled phenolic material and was classed as of mottled finish, being in a wide variety of bright colours in addition to black. The moulding itself is of interest, due to the brilliance of the lighter colours—reds, yellows and greens—which exhibit a clarity comparable with that to be found in one made of urea-formaldehyde.

In view of the age of this specimen, however, and the general tendency to class phenolic mouldings as being useless for the production of bright colours, the quality of the sample under consideration is in no doubt.

The material, as we shall see, is filled with wood flour, and there are aspects of this which are of interest in so far as the structural details of the moulding in general are concerned. As the question of colour is of some importance, various portions of the sections are illustrated in colour, in addition to the usual monochrome rendering; by this procedure the general study of such sections will be appreciably assisted.

A general view of the gross structure of this material is seen in monochrome in Fig. 378, at a magnification of 26 diameters. The field here seen illustrates the structure at a point where a large portion of the moulding, coloured red, meets a similar portion coloured black, with a small portion of green-coloured material sandwiched between them at one point. The line of demarcation between the red and black portions is shown by the dotted line AA; the small green portion is shown at B, the black portion is represented by the area below AA, and the red portion above.

It will be noticed that the photographic tone values of the black and red areas are very much the same. This is due to intentional use of an orthochromatic emulsion in conjunction with a green filter, in order that the effect (as seen) may be produced, for it was considered desirable to show as far as possible the line of demarcation by means of the filler orientation rather than by difference

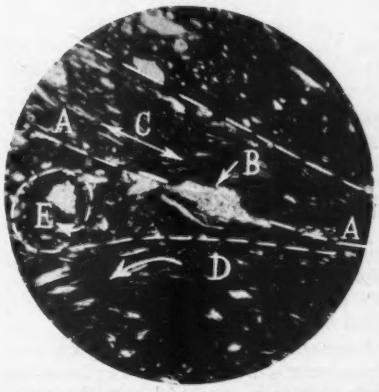


Fig. 378.—Section of old wood flour filled phenolic moulding (made 1922): general structure. Mag. 26 diameters.

in colour. This is clearly indicated, in this instance, due to the existence of differing flow patterns each side of the line; thus there has been considerable flow in the area marked C, producing the " horizontal " orientation seen in the larger wood particles in a zone near the line AA. At the same time, there has been less flow in the material of the black portion immediately on the other side of the line in the area marked E, but farther away from the line the black material shows quite considerable flow in the direction indicated in the area D.

From this it will be seen that the limit of the flow area appears to be dictated, to a certain extent, by the presence of particle B. For assuming the direction of flow in area D to be as shown, then the interference due to particle B may be expected to produce the " stagnant " area E, together with a series of vortices, the remnants of one of which appears to be present and which is indicated by the dotted arrow around the letter E. A similar condition, although somewhat less marked, may be discerned in the red area C.

The significance of this flow pattern is not at the present exactly clear, but a better understanding of the relationship existing between the various parts of the structure at this point is obtained by studying this illustration in conjunction with Fig. 378A. This illustration shows the same field in its natural colours, and drives home the fact that once more we are dealing with a material produced from a powder having not two parts, as in the case of the last specimen examined, but a multiplicity of parts whose number is equal to the number of coloured components in the final mixture. In the case of the specimen under examination, at least seven different colours or shades were capable of being easily distinguished.

From this it will be appreciated that the powder consists of seven fractions, each of which can, and actually does, behave as a filling medium for the others; that is to say, in the simplest case if any

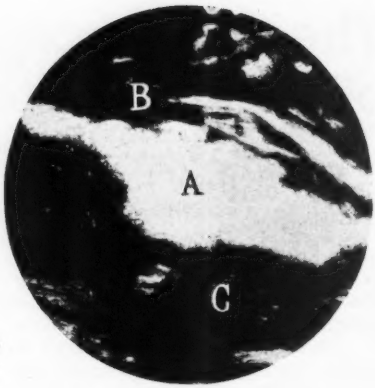


Fig. 379.—Section of same moulding at higher magnification. Mag. 100 diameters.

one fraction be considered as an individual functioning with the remainder as a matrix, then the relationship existing between them may be considered as being similar to that in the two-part powder previously mentioned. However, as the fractions are so numerous in the present example, the study of their behaviour becomes somewhat involved. Therefore, in order to simplify matters, we are forced to regard that fraction which is most preponderant as the matrix; in this case, the brighter colours are all seen to be set in a black background, indicating this latter to be the major fraction.

Having decided to consider the black material as the matrix, it immediately becomes clear that the conditions which are present indicate a reversal of those existing in the previously examined sample, for it will be remembered that this consisted of a two-part powder containing an unpigmented portion as the matrix with the pigmented part functioning in effect as a secondary filler.

In the present specimen, however, the black matrix material will be seen to be the pigmented portion, while the brightly coloured secondary fractions are not. Some slight indication of this is evident in the colour reproduction at Fig. 378A.

The green particle in this section is

fortunately placed, as information relating to two interfaces is obtainable; thus, in Fig. 379, the particle is seen at the somewhat higher magnification of 100 diameters. It should be pointed out, however, that the illustration in question was deliberately produced with a high contrast range in order that the boundaries of the green particle (A) would be clearly shown. This illustration appears in colour at Fig. 379A, where greater structural detail is visible; therefore it is recommended that colour and monochrome be studied together.

The green particle is fitted between the black matrix B, on the one side, and a large red secondary particle C on the other side. At this magnification it becomes evident that there is some difference between the black and green interface and that of the red and green, inasmuch as there appears to be distinct signs of fusion at the red and green interface, while that of the black and green appears to be devoid of this, thus resulting in a sharply defined junction.

It is also becoming evident that both the red and green secondary particles are unpigmented, their colour being due to dyes, so that in the one illustration we are able to study the behaviour of a secondary particle with the matrix on the one hand and with another secondary unit on the other hand. This would, at first sight, appear straightforward enough, and lead one to assume that the behaviour of all the secondary fractions, one with the other, will be the same. When, however, the structure of the green particle (as seen in Fig. 379A) is examined, it will be noticed that there are distinct signs of the presence of bubbles, but no such signs are apparent in the structure of the red particle, thus indicating a dissimilarity of a fundamental nature in the two materials.

The examination of this material will be confined to the question of red, green and black materials, as the two former fractions showed the greatest dissimilarity and were also in the largest proportions. The next largest fraction consisted of yellow dyed particles, whose behaviour

Fig. 380.—Section of same moulding: green/black interface. Mag. 600 diameters.

with the matrix and other particles was the same as that shown by the red. In the same way a blue fraction was eliminated. The other coloured fractions were shades and mixtures of the four basic colours just mentioned, and their structural details and behaviour were more or less as might be expected. In this way a fair amount of information is obtainable without the examination becoming clogged with unnecessary detail. Nevertheless, it is interesting to record that in the section examined the green material was the only fraction exhibiting the presence of bubbles; this demands examination in greater detail, and will be dealt with subsequently.

Having seen the indications of differing conditions existing at the two interfaces formed by the boundaries of the green particle, it is expedient to examine these in greater detail. A portion of the green/black interface is seen in Fig. 380, at a magnification of 600 diameters, the green portion being marked A and the black portion marked B. The line of demarcation is clearly defined and sharp, in spite of the high magnification, the point of greatest significance being the absence of the long extended processes which were so characteristic of the two part powders previously examined.

The only two cases which might be referred to as extended process occur at C and D, but these are small and ill-developed, and in fact may very well be due to the rough surface, originally existing on the black powder particle, being little altered in the processing. In fact, throughout the structure of this moulding there is very little evidence of the development of extended processes of any great size, even at places where two or more coloured powder particles are in juxtaposition. This would appear to indicate a low fluidity during moulding, although, as we shall see subsequently, other factors tend to suggest otherwise.

One interesting feature brought to light by this illustration is the difference in the average size of the wood flour particle to be found in the green and black; thus it is apparent that the filler used in the green material is appreciably finer than that found in the black. Hence the apparently wide difference in the two structures, which is due mainly to large wood particles in the black material being very much larger than their counterparts in the green; further, the colouring of the black fraction masks the presence of the finer portions of the wood flour filling it.

In spite of this, however, there is a wide difference in filler size between the two portions. The significance of this is not immediately apparent, but it is probable that by using a fine high-quality filler and resin, the brightness and clarity of colour so characteristic of this moulding, was attained and maintained. Thus it is probable that there is a considerable proportion of very fine particles in the green material which might have some effect on the fusion of the two materials at the interface, particularly as the black is pigmented.

When the red/green interface is examined, there are seen to be distinct signs of fusion between the two materials at this point, as evidenced by Fig. 381, showing this portion of the structure at 600 diameters. The red portion is indicated at A, and the green portion at B. From this illustration it will be seen

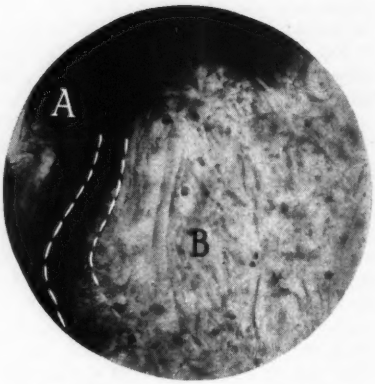


Fig. 381.—Section of same moulding: green/red interface. Mag. 600 diameters.

that where the two materials meet, fusion has occurred to about the extent shown between the dotted lines. This is more clearly seen in the coloured reproduction at Fig. 381A, where a difference of shade at the junction is clearly distinguishable, and as both red and green fractions are unpigmented, it follows that fusion will be liable to take place somewhat more readily in the case of materials carrying pigment. This condition is to be expected in the case in point; furthermore, it offers a certain amount of support to the view just expressed regarding the lack of fusion between the black and green fractions.

This latter condition, however, must not be regarded as being total, for it is clear that some degree of fusion of resin at the interface must occur, as otherwise the adhesion at each point would be very poor, if not absent entirely, resulting in a low-strength moulding with unsatisfactory characteristics. Therefore, there must exist a certain degree of fusion which in all probability takes place from the green to the black, as this latter would tend to flow much less easily due to the presence of the pigment, particularly so as the black pigment is very fine and, as will be demonstrated subsequently, is well distributed. Thus it is clear that fusion in this manner would be difficult

Fig. 382.—Section of same moulding: red/black interface. Mag. 600 diameters.

Fig. 383.—Red/black interface seen in Fig. 382, photographed on orthochromatic plate. Mag. 600 diameters.

to detect owing to the masking effect of the pigment in the black matrix.

The fusion which has occurred between the red and green fractions extends for only a short distance either side of the interface, resulting in the appearance of sharply defined edges to the various coloured areas as seen with the naked eye. This point is of some interest, because the effect produced was presumably desired, and the result indicates the exercise of some degree of control over the moulding conditions.

Speculation as to the nature of this control can lead to the development of interesting assumptions. Thus, for example, the effect could have been achieved by controlling the temperature and pressure in the mould so that the required degree of fluidity, and no more, was obtained. On the other hand, a similar result could be arrived at by careful control of the degree of curing to which the resin was subjected on the rolls, but in view of the structure of the dyed particles it is probable that all three factors were controlled to some extent.

Further evidence of the effect of the black matrix may be obtained by an examination of the junction of red and black materials, which is seen in Fig. 382, again at 600 diameters. This portion of the section illustrated occurs at a point where the section is very thin and was chosen with a view to illustrating as much as possible of the structure of the black material A. It will be seen that signs of pigmentation are visible in this latter; at the same time the interface of the red (B) and the black is seen to be very clearly defined, indicating a sharp boundary.

The absence of pigment migration from the black into the red would also be noted, as it gives rise to a possible hypothesis regarding the method which might have been adopted to keep the boundary sharp, inasmuch as if the fluidity of the matrix was kept by controlled curing and the addition of pigment. The result, as illustrated, might be expected, as the greater fluidity of the resin in the red material would allow for its penetrating the surface of the black, thus forming the bond. The possibility of the existence of what might be termed "undirectional" fusion at the interface is, therefore, worthy of consideration. The fusion, of course, takes place from the red into the black material.

The structure of the black material is chiefly remarkable for its homogeniety, as it will be noticed that such of the wood flour particles in which the wood structure is distinguishable, show a very high

degree of impregnation. Whereas it is intended to study this aspect of the material in greater detail, it is here worth pointing out an example of the type of completely filled wood particles such as that seen at the junction of the two materials at the centre of the photograph.

This element consists of three large vessels, seen in transverse section, each of which is completely filled with the pigmented resin; in fact, at the point illustrated, there exists a group of wood particles which are also well filled with resin. This is probably a major factor influencing the behaviour of the material at an interface, for, as has been previously pointed out, the presence of fairly large filler particles which were not well impregnated tended to produce a certain amount of blocking at the mould surface, which favoured the development of pockets of clear resin. This results in adverse effects on the surface finish.

In some respects, however, the interface under discussion may be compared to a normal mould interface, with the surface of the red fraction as the mould surface. This is only possible by virtue of the sharp line of demarcation. It will be seen that the structure of the black material consists of a group of fairly large particles (C) lying at the surface, but due to the complete filling and presumably the mobility of the resin, there is no evidence of the development of blocking.

This question of the mobility of the black materials raises the point of the effects of fluidity, in general, for it is obvious that each fraction of the moulding powder must possess some degree of fluidity if the moulding is to hold together at all.

We were enabled to study the structure of the black material in Fig. 382, but that of the red material is not so clearly distinguished. The reason for this lies in the technique of photographing the material; in the first place it was necessary to show the interface as clearly as possible, and whereas the contrast in colour is quite adequate for visual study, special steps have to be taken to produce the same contrast when recording the image in monochrome. Thus, to produce the effect shown, the photograph was taken on a panchromatic plate in conjunction with a red filter. The net effect has been to reproduce the red section in approximately its equivalent shade of grey tone. This results in the production of line detail, but little, if any, contrast in this section of the photograph.

If the image is photographed on an orthochromatic emulsion, however, contrast can be produced so that the structural details and the general arrangement of the components becomes clearly displayed. The reason for this lies in the difference in colour sensitivity of the two emulsions, the panchromatic medium being red sensitive, whereas the ortho emulsion is comparatively insensitive to red. The effect of this latter is seen in Fig. 383, where the same field is illustrated after having been photographed on an orthochromatic emulsion, through a light green filter. It will be seen that both sections of the specimen are rendered in the same general tone of black and grey, thus the interface has disappeared and it is impossible to distinguish the red from the black, except by the structural differences which now become apparent.

Here the interface lies along the dotted line AA, as shown by comparison with the previous illustration. The structure of the black portion remains unchanged in appearance, and needs no further comment. The red portion, however, is seen to exhibit signs of a considerable degree of flow with consequent orientation of the filler particles in the direction in which movement took place. This flow appears to signify a movement of the whole mass at this point, as against the comparative absence of such movement in the black portion.

Thus, one may conclude, as a preliminary, that the good impregnation of the filler in the black portion was more probably achieved during the processing of the black powder before moulding, as in the mould this fraction shows considerably less flow than the coloured

Fig. 384.—Section of same moulding: general structure of red portion. Mag. 100 diameters.

Fig. 385.—Same moulding: part of Fig. 384 at much higher magnification. Mag. 800 diameters.

materials. It must be remembered, however, that the presence of the pigment will help in producing the effect.

In studying the structure of the red material, the general homogeneity is seen to be very good, and the consistency with which quite large wood particles are seen to be completely impregnated and filled with resin, is little short of remarkable.

We see in Fig. 384 a general view of the type of structure to be encountered in the red portion, at a magnification of 100 diameters. In the centre of the illustration is seen a large wood particle (A), showing its structure to be in an excellent state of preservation, inasmuch as there is little if any evidence of distortion due to moulding. The reason for this lies in perfect filling of the structure with resin. The particle in question will be seen to exhibit structures both in transverse and longitudinal section; for example, the upper half of the particle consists of four typical softwood tracheids of spring wood, seen in transverse section, while adjacent to and below these, the other half is a portion of a medullary ray in longitudinal section.

In all cases the interior of the cells, that is, the bores of the tracheids, and the cavities of the medullary cells, are seen to be completely filled with resin. Likewise the two particles in longitudinal section, seen at B, are also completely impregnated. It is somewhat difficult to appreciate the full extent to which this has occurred by the monochrome illustration. A much better idea is obtained when the same field is seen in colour, as in Fig. 384A, where the photograph leaves no room for doubt as to the degree of filling of the wood particles. It is particularly clear in this case, as the resin is dyed a distinctive red, which has no effect on the cellulose of the cell walls.

The filling of the large wood particle is worthy of clear examination, and is illustrated at 800 diameters in Fig. 385, which shows three of the tracheids and a portion of the medullary ray tissue. The resin will be seen to have completely filled the structure of this particle, even to the extent of filling minute irregularities in the cell wall in the form of tiny pits. At the same time, the cell cavities of the medullary cells are seen to be completely filled. The end walls of the cells are not affected by the dye used in the resin, and therefore stand out against the red of the resin. This particle is illustrated in colour at Fig. 385A, together with another of similar nature at 385 B, showing excellent penetration of the resin.

(To be continued.)

LETTERS TO THE EDITOR

Correspondents are reminded that a stamped and addressed envelope should be enclosed in all cases where a personal answer is desired. It is understood that any letter received may be published at the discretion of the Editor.

P.V.C. Tubing

Sir,—We are continually receiving inquiries for p.v.c. tubing of various sizes, but are having a little difficulty in contacting the best sources of supply. We shall be glad if you will kindly advise us of the names of suppliers.

W. AND J. GEORGE AND BECKER, LTD.
Nivoc House,
17-29, Hatton Wall, E.C.1.

[EDITOR'S NOTE: As the inquirers are a well-known laboratory supplies concern, we presume that all such tubing is to be used for conveying gas, water, or chemicals. The available extruded plastic tubings are polyvinyl chloride, polyvinylidene chloride, and polythene, ranging from the very flexible to the rigid. Firms concerned in such extrusions are Duratube and Wire, Ltd., Faggs Road, Feltham; Tenaplas, Ltd., Upper Basildon, near Pangbourne, Berks; De La Rue Extrusions, Ltd., 84-6 Regent Street, London, W.1; Suflex, Ltd., Aintree Road, Perivale, Middlesex; Erinoid, Ltd., Lightpill Mills, Stroud, Glos.; and Greenwich Leathercloth Co., Ltd., Durex Works, St. Mary Cray, Kent.]

Moisture-proof Film

Sir,—I am faced with the problem of applying a moisture-vapour-proof film to cardboard cartons. I have investigated a large number of preparations reputed to have the required property, but none of them has proved satisfactory. The material should be suitable for application by a roller coating process and should preferably be non-inflammable.

J. C. B. TOMLINSON.
325, Leigham Court Road,
Streatham, S.W.16.

[EDITOR'S NOTE: It is difficult to see why the reader insists on a non-inflammable coating, since any applied film would necessarily be extremely thin and if the source of heat were continued could not be guaranteed to protect the cardboard container itself. Moreover, such a request eliminates the use of those materials with probably the highest resistance to moisture, i.e., paraffin wax, synthetic waxes and polythene. A new coating process using polythene has recently been developed by I.C.I. (Plastics), Ltd. If these are not to be considered, approach must be made to the chlorinated vinyl compounds, solutions and emulsions being both available — we suggest approaching Vinyl Products, Ltd., Butter Hill, Carshalton; L. H. Stace, Ltd., Swindon Road, Cheltenham; British Geon, Ltd., 21, St. James's Square, London, S.W.1; and Imperial Chemical Industries, Ltd., Plastics Division, Black Fan Road, Welwyn Garden City, Herts. We are unaware of the use of "Pliofilm" in this connection; rubber hydrochloride is available in these forms, but the Goodyear Tyre and Rubber Co. (Gt. Britain), Ltd., Wolverhampton, should be approached for advice on this subject.]

Tubes and Angles

Sir,—We require plastic tubing and angle sections for the manufacture of a small patent electric lamp fitting. It is necessary that the material be as inexpensive as possible. The type of finish is not important, but the tubing must be able to withstand the heat generated by a 25-watt lamp in close proximity.

GEO. R. GIBBONS (WIPERS), LTD.
Egerton Buildings,
East Ordsall Lane,
Salford, 3.

[EDITOR'S NOTE: Since the material may be opaque or transparent, extruded thermosetting or thermoplastic materials may be used. Phenolic extrusions are made in many cross-sections by Extruded Plastics, Ltd., Browell's Lane, Feltham, Middlesex. For p.v.c. and polythene extruders, see answer to another letter on this page. For cellulose acetate extrusions, application should be made to British Celanese, Ltd., and BX Plastics, Ltd. All the above are quite suitable to withstand the heat generated at a distance of $\frac{1}{2}$ to $\frac{3}{4}$ inch from the lamp.]

Fablon

P.V.C. SHEETING SETS ENTIRELY NEW STANDARDS

"Fablon" marks the biggest step forward in sheeting standards . . . greater tensile strength, better welding characteristics, flexibility in cold temperatures, colours fast to light, excellent adhesion to design after printing. "Fablon" is produced on plant in advance of any other in this country—is perfectly calendered and made with the highest grade plasticisers.

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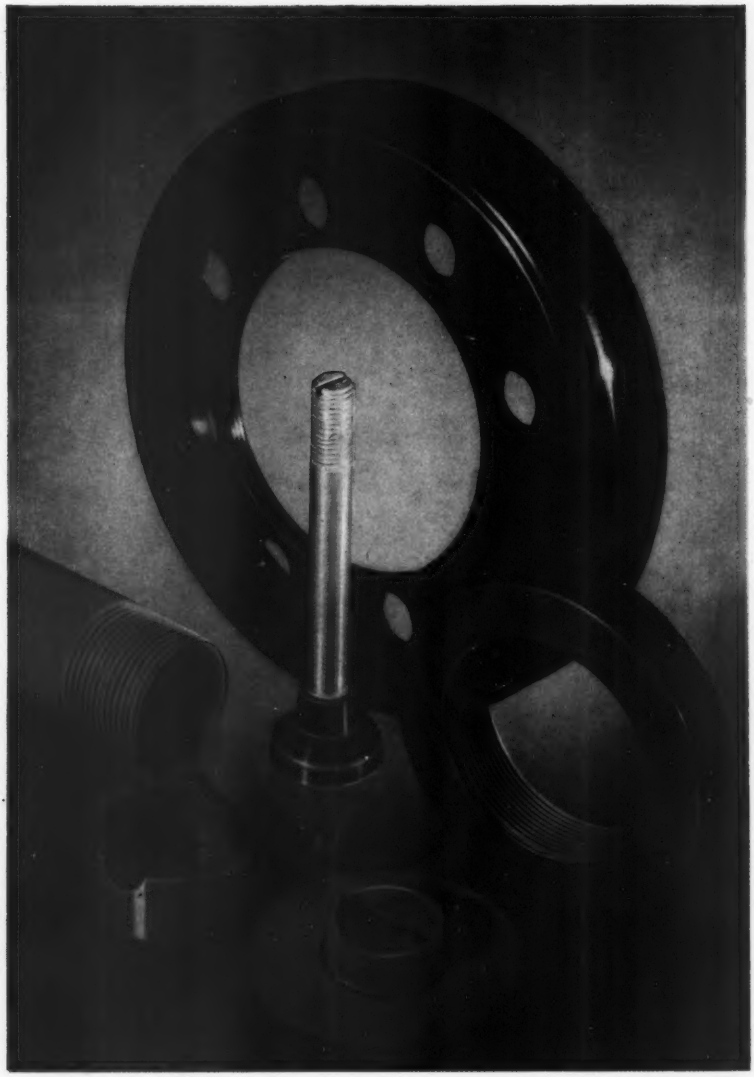
Examine—and compare—the superb finish, drape, suppleness and "feel." "FABLON" is supplied in frosted finish in natural and pastel shades, all normal thicknesses, widths up to 53", in transparent, opaque and metallic sheeting.

COMMERCIAL PLASTICS LTD. (Sales Department)
RAMILLIES BUILDINGS, HILL'S PLACE, LONDON, W.1. (GERrard 3966)



m and i

THE MICANITE & INSULATORS CO. LTD.

Empire Works, Blackhorse Lane, Walthamstow, London, E.17

Manufacturers of MICANITE (Built-up Mica Insulation). Fabricated and Processed MICA. PAXOLIN Laminated Materials. PANILAX Laminated Materials and Mouldings. EMPIRE Varnished Insulating Cloths and Tapes. HIGH VOLTAGE BUSHINGS and TERMINALS. Distributors of Micoflex-Duratube Sleevings and Micoflex-Durasleeve (Plastics-covered flexible metal conduit)

"Rattan" Seating

Sir,—We wish to contact the manufacturers (one or more) of a polythene compound for rattan seating. Up to the present time purchases have been made in the U.S.A. but we would like to contact a couple of first-class British manufacturers, and if, to save time, you could place our name before them and request that samples and prices be mailed to us, we would be most grateful.

HUGH CRAGGS.

El Patio,
Callejon De Luna No. 6,
Guatemala City, C.A.

Transparent Covers for Boxes

Sir,—We are wanting to secure transparent covers for spoon and fork boxes, and will be glad if you would recommend us to any likely manufacturer.

ANGORA SILVER PLATE CO., LTD.

Angora Works,
Regent Street,
Birmingham, 1.

Stiff Plastic Netting

Sir,—We would be grateful if you can advise us of any manufacturers of a stiff net made from plastic-coated yarns. We believe that the trade name in the U.S.A. is "Plexon," but we cannot trace any English trade name or maker.

BADGERDELL APIARIES.

Barnes Lane,
King's Langley, Herts.

Wall Panelling

Sir,—I am interested in establishing commercial relations with a manufacturer of building materials, especially wall panelling.

PAUL Q. SOUSA.

Aven, Elias Garcia, 144, 4°,
Lisbon.

Inquiry from Australia

Sir,—Clients of ours in Australia tell us that they want to purchase dies and/or manufacturing rights from British manufacturers.

We must admit that this inquiry is somewhat vague, but we know that our friends have an injection moulding plant which would enable them to produce injection-moulded articles in Australia from dies provided by British manufacturers.

W. A. SPARROW AND CO., LTD.

65 London Wall, E.C.2.

Elastomer

Sir,—We are interested in Elastomer 105, which is a product of the Electro Technical Products, Inc., Nutley, New Jersey, U.S.A. We understand that this is a thermoplastic material of the vinyl type. Could you let us know if this product is manufactured in the United Kingdom, or anywhere other than the U.S.A.

JAMES NORTH AND SONS, LTD.

Hyde,
Cheshire.

Plating Moulded Products

Sir,—We are endeavouring to get in touch with a firm known as "Metaplast," who carry out the plating of moulded products. We should be grateful if you could give us their full title and address.

Spring Gardens, E. GOMME, LTD.
High Wycombe.

[EDITOR'S NOTE: Metaplast (England), Ltd., Great North Road, Ferrybridge, Yorkshire.]

Plastic Letters

Sir,—Can you put us into touch with a firm supplying plastic letters, either moulded, stamped or extruded. The letters we have in mind should be in block capitals $\frac{7}{8}$ in. high and $\frac{1}{16}$ in. thick.

We are also interested in small toy plastic ladders, approximately 3 ins. in length and $\frac{3}{8}$ in. wide.

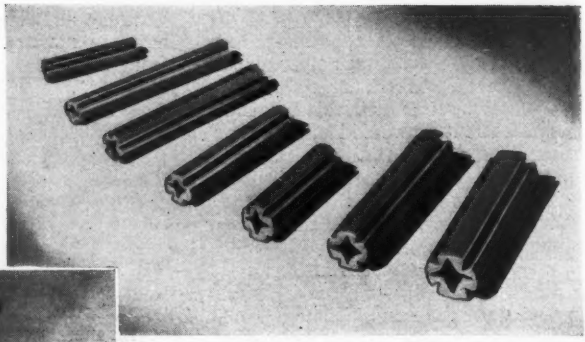
E. ISHERWOOD.

128, Westdale Lane East,
Gedling, Notts.

Export Inquiry

Jackman and Co., G.P.O. Box 363, 3rd Floor, Union Building, Hong Kong, inform manufacturers and exporters that they purchase extruded vinyl beltings for manufacture of belts and braces; plastic buckles; plastic combs; plastic "leather" for upholsterers; sheetings for handbags; plastic door handles; and phenolic resin slabs for Mahjongg tiles.

New Productions from the Moulding Shops



Cyclists' Bottle

This polythene drinking bottle is made for the special use of cyclists. Its main features are strength and light weight. Additionally, it is suitable for holding citrus fruit drinks, which have a tendency to corrode an aluminium bottle. The body of the bottle is injection-moulded in two halves, which are subsequently welded together. The method of closure is of particular interest; it comprises a cap moulded in one piece with an undercut to give a snap fit, thus making use of the natural spring of the material. The bottle is made by G. and E. Equipment and Contracts, Ltd., Mill Works, Ruislip, Middlesex, for J. Cecil Paget, Ltd., Bridgend, Glamorgan.

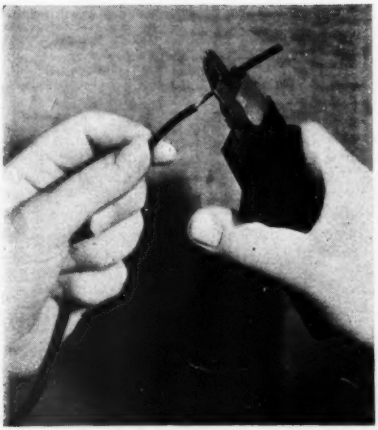
Plastic Wall Plugs

The "Hewit" wall plug is made from a tough but pliant plastic. It is of a unique fluted design. It is compressible, so that it can be inserted into a closely fitting hole; the screw then expands the plug, giving a neat finish and tremendous holding power.

"Pull-out" tests with these plugs have demonstrated their phenomenal holding power. For example, a 2-in. plug resisted attempts to pull the screw out to a maximum load of 2,965 lb. In other instances the screws broke in endeavouring to part them from the plugs. These plugs can be used in all materials—concrete, plaster, wood, rubber or glass. An especially noteworthy feature is that they will resist heat, water, moisture, weather and acids. The plugs also have good electrical characteristics and are immune to corrosion. They can be cleanly cut by a reasonably sharp knife. Hewit Wall Plugs, Ltd., 60 Fenchurch Street, London, E.C.3, are the suppliers.

Electrically Heated Pliers

Latest addition to the range of "Stanelco" tools marketed by Standard Telephones and Cables, Ltd. (Industrial Supplies Division), is the new p.v.c. stripper pliers, which are specially designed to remove the insulation from plastic-covered wires without damage to the conductor. While mechanical stripping weakens a solid conductor by "nicking," or in stranded conductors breaks through some of the strands, the "Stanelco" stripper pliers rely on the thermoplastic properties of the insulation to ensure clean stripping without charring the insulation or damaging the conductor. The jaws of the pliers are heated by a low-voltage current, which ensures perfect safety to the operator, and power consumption is negligible (over 100 hours'



operation on one unit of electricity). No switching is necessary, and the pliers can be left connected without risk of damage or overheating.

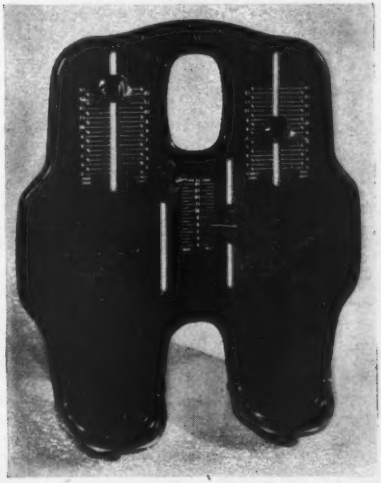
These pliers will remove the plastic insulation from any conductor, stranded or solid, up to ½-in. diameter faster than by any other method. The handles are moulded in Bakelite fabric material by E. Shipton and Co., Ltd., of Ferndown Works, Northwood Hill, Middlesex.

Grid Ring

Our description of a moulded engineering component illustrated in the February issue (p. 92) as a "gear ring" was incorrect. This moulding should have been described as a grid ring. We were also in error in giving the impression that the teeth on this ring were machined and not moulded. All the teeth were fully machined on to the steel mould, and each ring was moulded in the normal way. The making of the mould was, of course, a notable achievement, which ably reflects the skill of British Moulded Plastics. Ltd., in toolmaking aside from moulding.

Shoe Fitting Device

This "pedicator" is a standard fitment in all shoe shops of the principal Co-operative



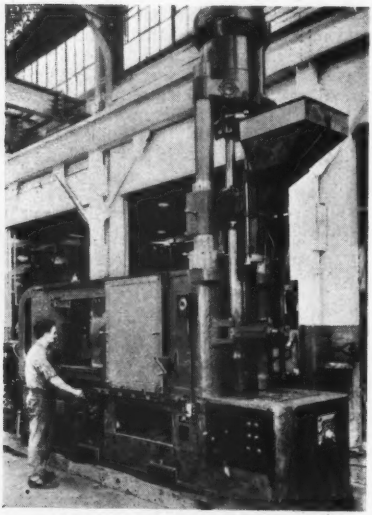
Societies. It simplifies the measurement of the feet in determining the correct size of shoe. The fitment is moulded in Bakelite material.

Motorcar Accessories

This steering wheel has been moulded over metal inserts, portions of which remain visible to the eye and provide for a refinement in design in the finished job. The motorcar door handles also have metal inserts. In both cases "Celastoid" moulding powders, products of British Celanese, Ltd., have been used. The number plate is fabricated from "Celastoid" sheeting. The steering wheel was moulded by Wilmot-Breeden, Ltd., Camden Street, Birmingham.

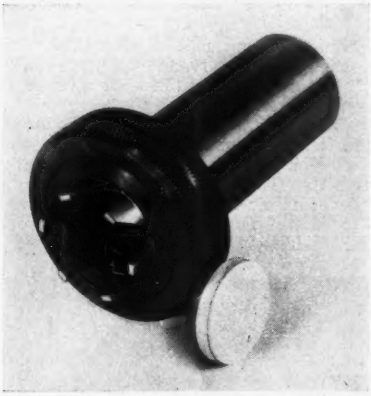
PRODUCTION NEWS

Raw Materials, New Plant, Works Organization, Control Apparatus, Research, Personal and Trade Notes



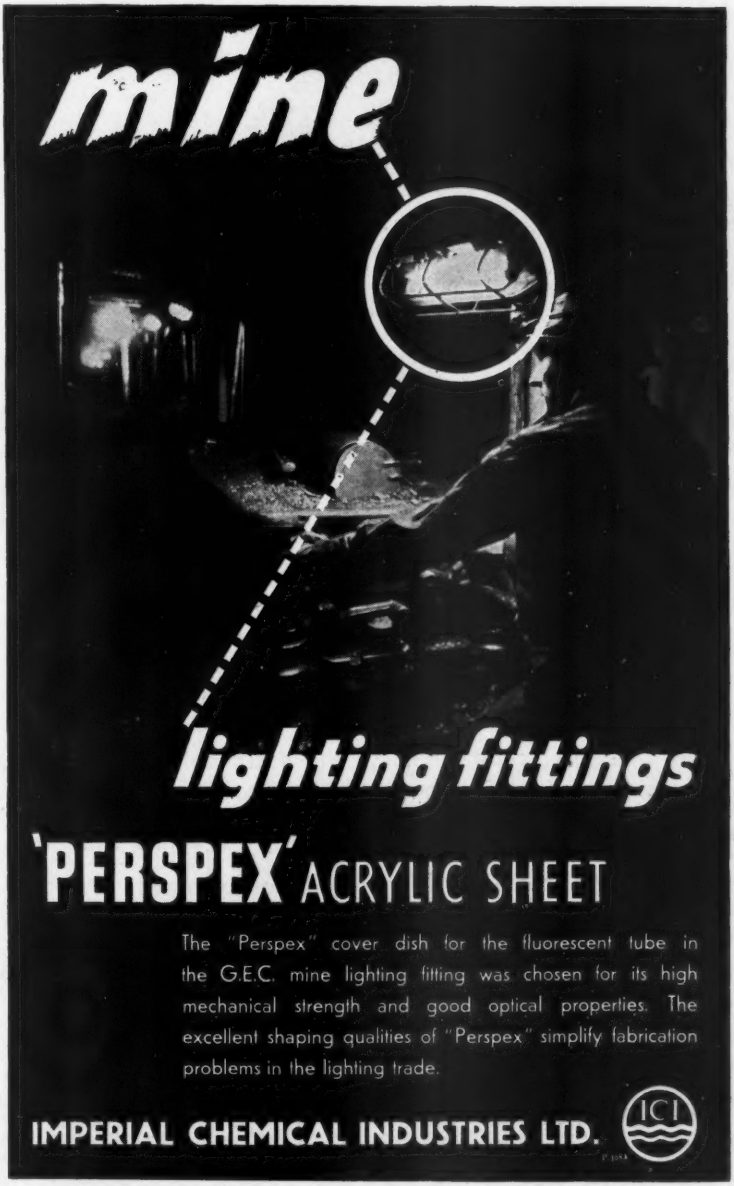
DOWDING AND DOLL, LTD., Greycoat Street, Westminster, S.W.1, have given us brief details of the 48-oz. vertical injection moulding machine manufactured by Lester-Phoenix, Inc., Cleveland 13, Ohio, for whom they are sole selling agents in the U.K. and continental Europe. This machine, seen in the above illustration, has a stationary die plate 29½ ins. by 40 ins. and a movable die plate 29½ ins. by 34 ins. Die height adjustment, 3 ins. maximum, is obtained by means of a single hand crank. The frame is of the box type, in a heavy one-piece alloy steel casting rated at 750 tons die-locking pressure. The cylinder has a solid plunger, one-piece electrically heated torpedo with separate temperature control, and three resistance-type external heaters, each with a temperature control instrument. A new cylindrical compensating feeder fills the injection cylinder at each shot in exact proportion to the previous shot. Gates and runners can be returned to the cylinder if desired. The moulding capacity is 64 cu. ins. (48 oz.) per shot; maximum number of shots per hour (varying with type of product), 120; total capacity of machine, 180 lb.; plasticized material per hour.

TREPANNING TOOL.—Recently concluded runs by a button manufacturing firm using a "Wimet" tungsten carbide trepanning tool have proved that a tool life of over eighty times that obtained from steel cutters can be expected on this class of work. The normal expectation of life between successive grinds on a steel tool is six gross, whereas the "Wimet" tool produced 500 gross between re-laps. The tool is assembled in three parts, thus facilitating the application of varying size standard cutters, which range from 15 line (0.375 in. diameter) to 55 line (1.375 in. diameter), in



steps of 0.025 in. Because the relapping of the cutting edge is performed without unnecessary loss of carbide over a prolonged production period, these trepanning tools (A. C. Wickman, Ltd., Coventry) are expected to show an improved economy many hundreds of times greater than ordinary steel tools. The cutter is the subject of a patent application. Our illustration shows the complete tool, with sample of work.

TURNED METAL PARTS.—The Anglo-Swiss Screw Co., Ltd., West Drayton, Middlesex, has specialized for nearly 30 years in the production of turned metal parts, including small screws and nuts, principally for use by light industry. Some account of their activities is given in available literature.



'PERSPEX' ACRYLIC SHEET

The "Perspex" cover dish for the fluorescent tube in the G.E.C. mine lighting fitting was chosen for its high mechanical strength and good optical properties. The excellent shaping qualities of "Perspex" simplify fabrication problems in the lighting trade.

IMPERIAL CHEMICAL INDUSTRIES LTD. ICI

Photographs reproduced through the courtesy of the Concordia Electric Safety Lamp Co., Ltd.

MINER'S *Safety* CAP LAMP

with headpiece moulded from shockproof phenolic material. A one-piece moulding giving the strength and complete insulation vital to a miner's lamp, and yet reducing assembly operations to a minimum. Accuracy is essential to meet the stringent requirements of the Mines Department.

Two side inserts for securing the dustproof switch and two inserts for fixing the contact springs are moulded into the headpiece. The cable entry hole is threaded, and the glass retaining bezel screws accurately on to a moulded thread so that the bezel can be positioned and securely fixed.

The headpiece mouldings and the mould made for the Concordia Electric Safety Lamp Co., Ltd. of Cardiff by . . .

BRITISH MOULDED PLASTICS LTD.
AVENUE WORKS • WALTHAMSTOW AVENUE • LONDON • E.4

THE MARK OF A NATIONAL PLASTICS COMPANY

B.M.122

EXPORT FORMS.—"The Board of Trade Journal" for February 19 contains the second report of the booking party appointed to consider the simplification of shipping notes, bills of lading and other forms used in the export trade.

POZNAN FAIR.—Among exhibitors at the Trade Fair to be held at Poznan, in Poland, from April 23 to May 10, are De La Rue Insulation, Ltd., and R. H. Windsor, Ltd.

WARERITE, LTD.—Technical improvements in the production of Warerite decorative laminated plastics are announced simultaneously with considerable reductions in the price of all standard grades. Improvement in production techniques has made possible reductions in price amounting, in some instances, to as much as 30 per cent. of the previous list price. The technical advances in surface hardness and new textile patterns are of comparable importance. All Warerite patterned materials will now have a surfacing of exceptional hardness. The new patterns are fine and open "weaves" in a pleasing range of colours.

UNITED EBONITE AND LORIVAL, LTD.—The future of plastics was the keynote at the Lorival 3rd Annual Sales Conference held recently at the Pack Horse Hotel, Bolton, and attended by all the sales representatives. In the conference room delegates saw a comprehensive exhibit showing p.v.c. sheeting and the innumerable mouldings in plastics and ebonite which the company has handled during the past year. The company is now going ahead with their original development programme which will cost over £250,000. This factory enlargement will allow a much larger output both of moulded plastics and ebonite and p.v.c. sheeting in the future.

LACRINOID PRODUCTS, LTD., have recently registered a new trade mark, "Tonall," which, for the time being, will be applicable to buttons only.

ROBERT McCARD AND CO., plastic moulders, etc., have recommended a final dividend of 100 per cent., against 140 per cent., on the £20,150 capital, making 150 per cent., less tax, against 190 per cent. Profit for 1948 was £88,754, against £95,247, and provision for taxation £46,000, against £53,000, leaving net profit £42,754 (£42,247).

REDIWELD, LTD., fabricators and welders in plastic materials, Broomhill Road, Wandsworth, London, S.W.18, have sent us a copy of their new leaflet describing safety features embodied in the design of their polythene jugs for the safer handling of acids and other corrosive liquids. These jugs were illustrated in "Plastics," December, 1948 (page 634).

DOHM, LTD., 167, Victoria Street, London, S.W.1., have commenced producing vermiculite in this country. This feather-weight mineral product is being widely used as an insulating material, and has numerous possible uses as an inert filler.

MR. R. W. GREENSTOCK, Midlands representative of B.X. Plastics, Ltd., for the past 25 years, retired on pension on January 31, 1949, after 50 years' service with the company. Known affectionately to friends as "Bob" Greenstock, he started in the Production Department at Brantham Works. After a few years, he moved to the Raw Material Sales Office at Hale End, and from there he went to the Company's office in Nurnberg, Germany, where he spent over three years studying conditions in the German market, which was a very important export outlet in pre-1914 days. On his return from service in the 1914-18 War, one of Mr. Greenstock's first jobs was to introduce "Lactoid" casein plastic in the London area when the British Xylonite Co. commenced manufacture, and while so engaged became known to all casein button manufacturers in London. His next and last move was to the Birmingham area as chief representative. Here he found his main life's work, and built up a connection for his company that broke all records. His place in Birmingham will be filled by Mr. C. A. Britton, assisted by Mr. W. R. Greenstock, Bob's younger son.

MR. R. W. BENNETT, having terminated his full-time engagement with B. Lipman (Plastics), Ltd., has now set up on his own account as Bennett Plastics, at 53a, Sutherland Avenue, London, W.9. Phone: Cunningham 6762. He will act as a manufacturers' agent and consultant, devoting his attention also to new processes in sheet plastics, coated fancy fabrics and coated heat-sealing papers.

PLASTICS INDUSTRY GOLFING.—About 230 members of the Plastics Industry Golfing Society and their guests attended an enjoyable dinner-dance at the Savoy Hotel, London, on April 1. Mr. C. C. Last, chairman of the Society, presided and among those present were Mrs. Last, Mr. and Mrs. Hector Woolveridge, Mr. and Mrs. P. A. Delafield, Mr. and Mrs. Herbert Bridge, Mr. T. L. Birrell, vice-chairman of the P.I.G.S., and Mrs. Birrell, and Mr. and Mrs. F. P.

Wilson, of New York, who are on a visit to this country. The guests saw a showing of a film made during the past year, which recorded the outstanding golfing events of the Society during 1948.

S.P.I., NEW YORK.—The appointment of William H. MacHale as chairman of the Public Relations Committee of the Society of the Plastics Industry, Inc., New York, has been announced. Mr. MacHale headed the special Exposition Publicity Committee set up for the 1948 National Plastics Exposition sponsored by S.P.I. Associated for 15 years with American Cyanamid Co., Mr. MacHale is sales promotion manager of the Plastics Department of the Plastics and Resin Division of that company.

EXPORT LICENSING CONTROL.—An order which became operative on April 8 extends export licensing control over a wider range of goods having potential military value. Included under this heading are mica slabs, sheets and splittings; siloxanes, whether polymerized or not, and if containing 50 per cent. or more by weight of siloxanes (a) silastics and (b) siloxane compounds, greases, resins and fluids.

THE BRITISH XYLONITE CO., LTD., announce that Mr. T. L. Birrell, Sales Director of B.X. Plastics, Ltd., has resigned from his position in that Company, and has joined the board of Halex, Ltd., in the capacity of Assistant Managing Director.

FORTHCOMING MEETINGS

Apr. 13.—"The Alginates." R. H. McDowell. Plastics Institute, Southern Section. Polygon Hotel, Southampton.

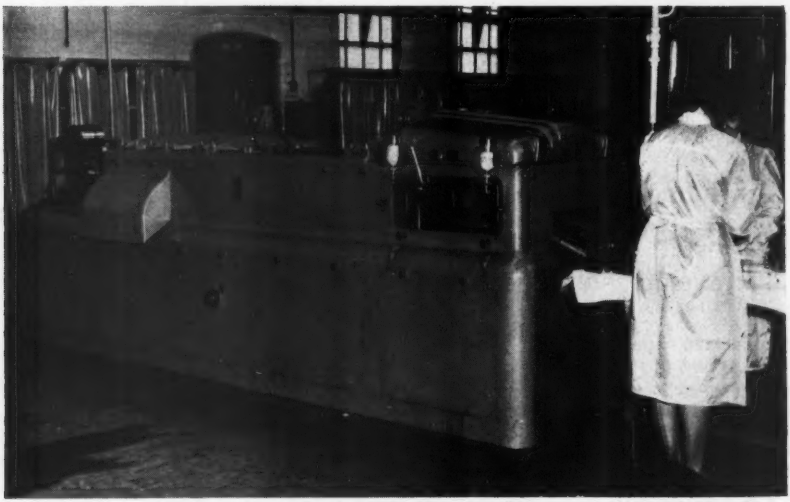
Apr. 13.—"Industrial Management." Speaker to be arranged. Plastics Institute, Yorkshire Section.

Apr. 27.—"Plastics in Packaging." J. L. Denny. Plastics Institute, London Section. Waldorf Hotel, Aldwych, W.C.2.

May 2.—"Leather: the Scientific Background to a Traditional Industry." M. P. Balfe. S.C.I., London Section. London School of Hygiene, Keppel Street (Gower Street), W.C.1. 6.30 p.m.

May 11.—"Optical Plastics." D. Starkie (I.C.I., Plastics Division). Plastics Institute, Yorkshire Section.

May 20.—Plastics Institute, Midlands Section. Subject to be announced.



HIGH-SPEED BOX MAKING

On March 10 we had the pleasure of examining at the works of Cascelloid Ltd., in Leicester, the first "Trans-Bo-Matic" machine to be installed anywhere in the world. The acetate film is fed continuously and automatically into a number of "stations," where it is cut, folded and cemented into the finished transparent boxes, at the rate of about 1,000 each hour. For technical details see Mr. Stannett's notes on page 183.

CONVERT YOUR PLASTICS INTO DAZZLING JEWELLERY

BY THE NEW **METAPLAST** PROCESS

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FREE TEST OFFER. METAPLAST specialist service will advise **FREE** on drawings, blue prints, sample mouldings, and will produce, on request, a sample plated with the metal desired.

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We invite Manufacturers, faced with any Moulding difficulties, to communicate with us, without the slightest obligation on their part.

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EINAR HOLMARK, 19, Gl. Kongevej, Copenhagen V, Denmark

Quality Control in Plastic Moulding—XVII

By W. M. HALLIDAY

In this concluding article in the series, much of the argument of preceding instalments is briefly summarized in order to elucidate several important outstanding questions.

Usually additional problems arise when setting up quality control by dimensions in connection with productions from multi-impression moulds. To illustrate the nature of these problems and the manner of the solution, an actual example has been chosen. This is a compression moulded ring produced in a 12-cavity mould. Certain dimensions are to be held to precision limits.

From the actual working out of the data, and requirements needed to institute quality control, readers will appreciate how the production moulder is able to determine several vital questions stated in the text.

TO conclude this series of articles, in which the basic principles and methods of application of quality control inspection procedures have been explained and illustrated, a number of points which undoubtedly will arise for settlement when first instituting such a scheme must now be considered.

Problems of Multi-cavity Moulds

These points will be specifically associated with the operation of multi-impression moulding tools, in connection with which the production moulder will have to determine the undermentioned questions.

Two clearly defined forms of quality control methods are available, these being generally the most applicable to general plastic moulding applications. These methods are (1) control by dimensions, and (2) control by fraction-defectives. Both methods and their applications have been discussed in the earlier sections.

When contemplating setting up quality control type of inspection, the production moulder will first have to decide which form of control has to be used. This is a most important practical point, because its satisfactory solution will determine in large measure the accuracy and uniformity of the components produced, and particularly whether they can be produced within the drawing tolerances. With mouldings possessing precisions dimensional features the production moulder must first settle this point.

As a safe general guide to such a decision, it may be taken that inspection control by fraction-defectives is only safe and reliable when the permissible final and total defective rate is high. To maintain the defective rate within close limits, say, below 1½ per cent. to 2 per cent. of the total output, dimensional control will be advisable.

The requirements of the individual component will also have to be taken into consideration when settling this point. Thus, if the component has to be held to precision limits of variation on certain dimensions, or to fine standards of quality in any other respect, then control by dimensions rather than by fraction-defectives should be employed.

Difficulties are particularly apt to arise when using a multi-impression moulding tool, because before any system of quality control can be introduced, it will have to be determined whether the tool is capable of manufacturing to the drawing limits, and whether each cavity impression is sufficiently accurate and uniform on essential sizes and is producing components well within drawing limits, to ensure a safe average value being obtained for the purposes of plotting the control chart.

A Practical Example

To illustrate the manner in which these questions are resolved a very interesting example is now selected, and the relevant calculations and working out of the requisite data is recorded.

This example (Fig. 1) is a small adaptor

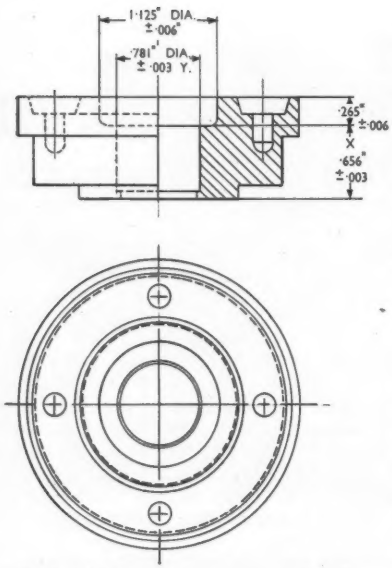


Fig. 1.—Adaptor ring component with two precision dimensions, produced from a 12-cavity mould.

ring in phenolic material, produced in large quantities from a 12-impression tool. Only the critical dimensions are shown on the sketch. These are the depth, X, i.e., .656 in. nominal size, which has to be held within plus or minus .003 in.

The moulded hole, formed by a single-core plug of three diameters, passes through the entire length of the component as shown. The middle and longest portion, Y, has to be held within close limits, i.e., .781 in. nominal plus or minus .003 in.

The correct and accurate coring of this hole will present no serious problems, since all these sizes will be controlled largely by the quality of the core plug incorporated in the mould. There will, of course, be several possible sources of variation, but most of these will not arise with the new mould, but only after a period of use. Thus, for example, variations in the critical dimensions of the component might occur as a result of wear occurring on the sides of the core plug; or from variations in the quality and uniformity of the material powder; or as the outcome of the lack of uniformity in the speed of ejection of the finished components, due to some mechanical wear or minor faults in the tool.

All these undesirable conditions, however, will usually be capable of simple correction or avoidance. For instance, it will be a comparatively simple matter to inaugurate some inexpensive periodical checking of each core plug in the mould to determine the extent of any wear taking place thereon. Likewise, the grade of powder used can generally be stabilized to give uniform moulding results.

The third ejection can usually be satisfactorily overcome by the development of a complete sequence of movements covering the stripping of the mould and the ejection of the finished articles. By the provision of simple yet effective equipment the mould operator will be enabled to extract each moulded component quickly, and at a uniformly constant pace throughout a production run.

The most careful attention will have to be devoted to this point, however, when the moulded component possesses relatively thin side walls each side of the central hole. Thin-walled articles of this kind may become stretched as a result of retaining them too long on the core plug during ejection. The normal shrinkage of the component would then largely be absorbed by the expansion of the side walls, as a consequence the hole might be formed too large.

With the dimension X in our present sample, however, an entirely different problem—or, rather, a set of problems—will arise. Variations in this dimension may occur as a result of fluctuation in moulding pressure. This, in turn, will affect the degree of closure of the top mould force, thereby causing variations in the length of the component.

The ability of the top mould force to resist distortion or deflection when sub-

jected to the maximum pressure from the press ram, will also have a considerable influence upon the uniformity and accuracy of the dimension X. An excess of moulding powder charge admitted to the mould cavity would tend to produce similar variations in the overall length of the part. Incorrect temperature of the mould during cure may also tend to vary this critical dimension. If the temperature is too high, curing of certain portions of the moulding will be accelerated and the proper flow interrupted. This would, in turn, restrict the closure of the top force at certain points, so producing variations or fluctuations in the length of the component.

The remedies for most of the above undesirable features will be obvious, and, fortunately, in most instances will be capable of easy application.

When wishing to install a quality system of inspection for the production of this component from a multi-impression tool, and to the specified limits laid down by the drawing, the first point to be satisfactorily disposed of will be whether the moulding tool is capable of producing consistently to the limits stipulated, and, if not, in what manner and degree it fails to do so.

It often happens when a new moulding tool is first placed into production, that articles possessing the required accuracy cannot be produced. If the production moulder is able to determine easily and exactly how much it falls short of the specified limits, and upon which particular dimensions the greatest variations occur, or which mould cavities give the most uniform results, usually something can be done to improve or correct the tool.

By facilitating the determination of such essential points, one of the greatest utilities possessed by quality control procedures will be made available for the guidance of the production moulder. In view of the great practical interest of such matters, the following detailed working out of the scheme will be found of guidance.

Setting Up Quality Control

First, the entire moulding operation should be standardized so far as practicable. Operating movements, and their sequences, must be predetermined so as to obviate all wasteful motions, and to ensure the economy of time during the ejection stages particularly. The mould, if not new, should also be carefully overhauled to compensate for any wear, slackness, or mechanical misalignments. It should be capable of being operated smoothly and efficiently. Equipment needed for opening the mould forces, removing the finished moulded parts, applying and measuring the powder charge, etc., should also be of the correct design to ensure safe and rapid operation.

These items are stressed especially because, in numerous instances, the author has found that where a system of quality control inspection has been applied, with unsatisfactory results, the causes have been in connection with one or other of these purely mechanical aspects of mould usage, or the lack of organization of the handling operations, and not due to inherent deficiencies in the system of quality control.

Having settled all these and associated matters satisfactorily, a number of sample mouldings are then taken from each cavity. Four individual sample parts are taken from each cavity, at intervals of 20 minutes, 10 such sample batches being taken. The sample units may be selected quite at random, or in sequence, exactly as produced from the mould. By this means 40 samples will be taken from each cavity, or a total of 480 individual components in all, from the 12 cavities of the mould.

The reasons determining the quantity of units per sampling batch, and the frequency of the sampling checks, have already been fully explained.

When taking these samples, those from each cavity must be carefully segregated from the rest, as it is important when checking the accuracy of each cavity not to mix the components.

Each set of samples is carefully

MOULD CAVITIES

SAMPLING PERIODS	1	2	3	4 ※	5	6	7 ※	8 ※	9	10	11 ※	12
1	·6558	·6548	·6546	·6517	·6556	·6543	·6525	·6520	·6570	·6565	·6510	·6565
2	·6550	·6540	·6550	·6528	·6545	·6570	·6515	·6530	·6580	·6560	·6520	·6590
3	·6540	·6535	·6535	·6530	·6550	·6560	·6510	·6500	·6565	·6575	·6515	·6580
4	·6560	·6530	·6570	·6515	·6560	·6535	·6500	·6490	·6580	·6580	·6510	·6585
5	·6545	·6555	·6575	·6505	·6550	·6530	·6505	·6485	·6570	·6565	·6520	·6570
6	·6530	·6540	·6585	·6540	·6535	·6550	·6527	·6500	·6575	·6555	·6485	·6560
7	·6575	·6575	·6580	·6520	·6570	·6565	·6530	·6515	·6565	·6540	·6480	·6545
8	·6535	·6570	·6555	·6500	·6565	·6575	·6520	·6520	·6550	·6570	·6520	·6550
9	·6560	·6560	·6560	·6515	·6555	·6565	·6505	·6530	·6565	·6595	·6530	·6565
10	·6575	·6555	·6565	·6535	·6585	·6535	·6500	·6545	·6585	·6575	·6535	·6560
AVERAGE X VALUE	·6553	·6551	·6562	·6519 ※	·6557	·6549	·6514 ※	·6510 ※	·6570	·6568	·6512 ※	·6567

DWG. TOL. ·659 IN.
·653 IN.

AVERAGE SIZE PER SAMPLE $\bar{X}$ = FIGURES IN BOTTOM LINE OF TABLE

GRAND AVERAGE $\bar{\bar{X}}$ = ·6544.

GRAND AVERAGE $\bar{\bar{X}}$ AFTER CAVITY CORRECTION = ·6556.

Fig. 2.—Tabulated data to indicate the accuracy and relative uniformity of cavities.

measured on the important dimensions, i.e., the hole diameter, and the overall length X, and the results tablulated upon a simple chart (Fig. 2). Two such tables of identical layout should be employed, one for receiving the data respecting the hold diameter Y, and the second for the data about the dimension X; Fig. 2 refers only to this latter measurement. It will be noted that the dimensions are taken to four decimal places; in the interests of accuracy this is desirable.

The purpose of this preliminary tabulation is to give an indication of the *relative quality and accuracy of each mould cavity.*

This table is divided into 12 vertical compartments, one for each of the 12 cavities; 10 equal horizontal divisions are also provided, each one representing the sampling times allocated to the job. The values shown inserted into the table are in each case the *average measurements* of the set of *four componments* in each sampling batch.

Below the 10 horizontal spacings is another compartment, wherein may be recorded the average value bar X, which is the sum of values contained in the 10 spaces above divided by 10. This figure, therefore is the average of 40 components taken as samples. A similar figure should be worked out for each of the 12 cavity values as shown.

This data immediately demonstrates whether any particular mould cavity is producing parts within or beyond the drawing tolerances on the dimensions checked. The extent of any failure to adhere to such tolerances is also clearly indicated.

Thus it will be observed from Table 2 that cavities numbered 4, 7, 8 and 11 are producing components well below the drawing limits. This fact may be checked in a twofold manner. Thus one may observe the respective average values given for each set of four components, at each sampling period, which in the case of cavity number 4 range from .6515 in. to .6540 in. Generally these values are seen to be substantially below

			MOULD CAVITIES								
DIFFERENCE BETWEEN HIGHEST & LOWEST VALUES = R			1	2	3	8	9	10	11	12
SAMPLING PERIODS		1	·6563 ·6563 ·6570 ·6546	·6559 ·6556 ·6564 ·6555						
	·0024	AVGE	·6558	·6548						
		2	·6556 ·6564 ·6541 ·6559	·6557 ·6530 ·6531 ·6542						
	·0018	AVGE	·6550	·6540						
		3	·6557 ·6552 ·6537 ·6534	·6545 ·6527 ·6557 ·6521						
	·0025	AVGE	·6540	·6535						
		4	·6541 ·6573 ·6577 ·6550	·6533 ·6537 ·6522 ·6528						
	·0056	AVGE	·6560	·6530						
		5	·6556 ·6532 ·6554 ·6536	·6552 ·6567 ·6543 ·6558						
	·0026	AVGE	·6545	·6555						
		6	·6515 ·6540 ·6545 ·6550	·6556 ·6552 ·6551 ·6541						
	·0050	AVGE	·6532	·6540						
		7	·6584 ·6565 ·6562 ·6588	·6567 ·6573 ·6571 ·6589						
	·0025	AVGE	·6573	·6575						
		8	·6541 ·6542 ·6530 ·6524	·6572 ·6550 ·6578 ·6580						
	·0020	AVGE	·6535	·6570						
		9	·6540 ·6553 ·6573 ·6576	·6546 ·6557 ·6568 ·6572						
	·0056	AVGE	·6560	·6560						
		10	·6555 ·6565 ·6579 ·6584	·6557 ·6544 ·6570 ·6549						
	·0029	AVGE	·6575	·6555						
$\bar{R}$	·0027	AVERAGE RANGE								

Fig. 3.—Partially completed table showing data required to determine average range values.

the drawing limits. Similarly with respect to the average value bar X shown at the foot of each cavity column. In the case of cavity No. 4 this is only .6519 in. In other words, this cavity is producing the mouldings consistently at least .0011 in. below the bottom limit and .0041 in. below the nominal size of .656 in.

The same condition is revealed in respect of cavities 7-8 and 11. From these figures, therefore, it is at once apparent that these four cavities require correction. The core plug for cavity No. 4 will have to be enlarged (.656 − .6519) = .0041. Cavity No. 7 will have to be provided with a core plug .0046 larger, cavity No. 8 will require a plug .005 larger, and cavity No. 11 will require a core .0048 larger.

From these results it will be apparent to the production moulder that the tool is well able to produce mouldings to the limits set by the drawing, since the productions from eight cavities are well inside such limits.

The amount of correction action required to the four affected cavities is also very easily computed. Once the cavities have been appropriately corrected and sufficiently reliable data obtained in Fig. 2, the information contained therein may be used for the purpose of eliciting other points which arise.

For example, with the control chart it is necessary to ascertain a value known as the "grand average," usually denoted by the symbol "double bar X." This is easily obtained from Fig. 2. If the 12 average values for "bar X," given in the bottom horizontal spacings, are added together and the result is divided by 12, the resultant figure will be that desired. This figure is indicated at the right-hand side of the table, and, of course, is .6544.

Whilst this figure is well within the drawing limits for this critical dimension, since it is an average of 12 values, four of which are known to be unsatisfactory, it should not be employed, otherwise misleading results would occur and a certain large percentage of faulty components be produced.

Therefore, it would be unwise to use this figure for the determination of the control datums required on the control charts which are to be constructed later. The affected cavities would have to be

modified to the degree just mentioned to bring the resultant values within the drawing limits.

After effecting such modifications to the four affected cavities, fresh sampling batches should be taken from these items, as before, and the measurements obtained recorded in the table. At the right-hand side of the table at Fig. 2 is shown a corrected "grand average" value (double bar X), obtained from the new measurements. This is now .6556, which is sufficiently well within the specified drawing tolerances to permit the next step to be taken in the construction of a proper control chart.

Practically all the essential data necessary for this purpose are contained in the table given above. The exception is the information needed to ascertain the "range average," or value "bar R."

Explanations of the derivation and functions of this value have already been given in an earlier article. Briefly, this is obtained from the range of variation observable in the sampling batches. To obtain this it will be necessary to tabulate the dimensions of each component in a sampling set of four, as at Fig. 3.

This table is very similar in layout to that shown at Fig. 2. Vertical columns are provided for each of the 12 cavities, because it is still advisable to isolate the results from each cavity, as will be understood later. The horizontal compartments are numbered 1 to 10, to coincide with sampling times, as before; these, however, are larger, because each one of the four measurements taken over every sample set of four components must be shown.

Immediately below each of these sampling period compartments is a small space for recording the average value. This, of course, is obtained by adding the four measurements given above and dividing by four. This fifth average value, by the way, is exactly the same as is inserted into the table shown at Fig. 2.

To ascertain the "average range" value ($\bar{R}$), the lowest individual dimension is taken from the highest in each set of four. In the table at Fig. 3 the lowest dimension is marked with a single bar above the figures and the highest with a double bar. The result in each case is shown in the extreme left-hand column, opposite to "average value." This result is denoted by the symbol R.

To obtain the "average range" value ($\bar{R}$), all the 10 values for R are added and the sum is divided by 10 to give the result shown in the extreme left-hand bottom corner of the table at Fig 3, i.e., .0029.

With this value, and that of double bar X previously ascertained (see Fig. 2), all the data needed to compute the location of the control datums on the average and range control charts will be available.

To do this, certain constant values will also have to be employed, three being readily extracted from one of the standard publications on quality control. For the sake of brevity, the working-out of these standard values is omitted. For this particular example they are as follows. $A_2 = .729$, $D_3 = 0$, $D_4 = 2.282$.

Armed with these, we may now calculate the values for the control limits on each graph to be used in the hour-to-hour inspection.

These values and formulæ for the average graph are:—

$$\text{Upper control limit} = \bar{\bar{X}} + A_2 \times \bar{R}$$
$$= .6556 + (.729 \times .0027)$$
$$= .6575$$
$$\text{Central control limit} = \bar{\bar{X}} = .6556$$
$$\text{Lower control limit} = \bar{\bar{X}} - A_2 \bar{R} = .6537$$

The values for the range graph will be obtained from the following formulæ and data:—

$$\text{Upper control limit} = D_4\bar{R} = 2.282 \times .0027$$
$$= .006 \text{ in.}$$
$$\text{Central limit} = \bar{R} = .0027 \text{ in.}$$
$$\text{Lower limit} = D_3\bar{R} = 0 \times .0027$$
$$= 0$$

These values may now be transferred direct to their respective graphs and the exact position of the control datums con-

(Continued on page 228.)

PATENT REVIEW

The following abstracts have been made from specifications at the Patent Office with the permission of the Controller of H.M. Stationery Office. Complete specifications can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1/- each.

B.P. 610,129. Appl. 27.3.46. Acc. 12.10.48.
Stabilized Olefinic Polymers and Co-Polymers. To: Standard Oil Development Co.

Refers to the stabilization of co-polymers with 2, 6 tertiary butyl, 4-methyl phenol. The preferred co-polymers are made from isobutylene and butadiene or isoprene or styrene and isobutylene or isoprene.

B.P. 610,135. Appl. 28.4.46. Acc. 12.10.48.
Recovery of Terephthalic Acid from Polyesters. R. L. Heath. To: Imperial Chemical Industries, Ltd.

B.P. 610,136. Appl. 28.3.46. Acc. 12.10.48.
Degradation of Aromatic Linear Polyesters. R. L. Heath. To: Imperial Chemical Industries, Ltd.

B.P. 610,137. Appl. 28.3.46. Acc. 12.10.48.
Incorporating Pigments or Delustrants with Highly Polymeric Linear Esters. J. T. Dickson, R. L. Heath and R. J. W. Reynolds. To: Imperial Chemical Industries, Ltd.

B.P. 610,138. Appl. 28.3.48. Acc. 12.10.48.
Stabilizing Highly Polymeric Linear Esters. J. R. Lewis and R. J. W. Reynolds. To: Imperial Chemical Industries, Ltd.

Stabilization of highly polymeric linear esters by incorporating small amounts of monofunctional compounds (benzoic acid, phenoxyacetic acid, stearic acid, nicotinic acid, etc.).

B.P. 610,139. Appl. 28.3.46. Acc. 12.10.48.
Preparation of Aromatic Polyesters for Melt Spinning. J. T. Dickson, R. L. Heath and R. J. W. Reynolds. To: Imperial Chemical Industries, Ltd.

B.P. 610,140. Appl. 28.3.46. Acc. 12.10.48.
Melt Blending of Aromatic Polyesters with other Polymeric Materials. J. T. Dickson and R. J. W. Reynolds. To: Imperial Chemical Industries, Ltd.

B.P. 610,152. Appl. 28.3.46. Conv. (U.S.A.) 25.7.45. Acc. 12.10.48.
Manufacture of Articles coated with Organo-Silicon Compositions. E. L. Warrick. To: Corning Glass Works.

B.P. 610,167/8/9. Appl. 29.3.46. Acc. 12.10.48.
Sizing of Aromatic Polyester Yarns. R. J. Smith. To: Imperial Chemical Industries, Ltd.

B.P. 610,170. Appl. 29.3.48. Acc. 12.10.48.
Plastic Articles reinforced with Filaments, Fibres, Yarns, Fabrics and the like. B. P. Ridge and J. T. Watts. To: Imperial Chemical Industries, Ltd.

B.P. 610,171. Appl. 29.3.46. Acc. 12.10.48.
Woven Fabrics. B. P. Ridge. To: Imperial Chemical Industries, Ltd.

B.P. 610,183. Appl. 29.3.46. Acc. 12.10.48.
Heat Treatment of Highly Polymeric Linear Esters in the form of Fibres, Yarns, Bristles, Films, Fabrics and the like. P. W. Carlene. To: Imperial Chemical Industries, Ltd.

B.P. 610,184. Appl. 29.3.46; 17.12.46. Acc. 12.10.48.
Hot Wet Processing of Molecularly Oriented Shaped Articles formed from Aromatic Linear Polyesters. R. G. Bartlett. To: Imperial Chemical Industries, Ltd.

B.P. 610,202. Appl. 30.3.46. Acc. 12.10.48.
Artificial Films. J. C. Swallow, D. K. Baird and B. P. Ridge. To: Imperial Chemical Industries, Ltd.

Refers to polyethylene terephthalate films.

B.P. 610,203. Appl. 30.3.46. Conv. (U.S.A.) 11.4.45. Acc. 12.10.48.
Production of Form-stable, Rubber-like Polyvinyl Isopropyl Ethers. A. D. Zoss. To: General Aniline and Film Corp.

B.P. 610,264. Appl. 3.4.46. Conv. (U.S.A.) 3.4.45. Acc. 13.10.48.
Fibre Forming Synthetic Linear Polyamides. To: E. I. Du Pont de Nemours and Co.

B.P. 610,301. Appl. 9.4.46. Conv. (Sweden) 26.4.45. Acc. 13.10.48.
Teat Cups for Milking Machines. To: Aktiebolaget Manus.

B.P. 610,304. Appl. 30.9.42. Acc. 14.10.48.
Production of Linear Polymers containing Heterocyclic Rings. S. J. Allen and J. G. N. Drewitt. To: British Celanese, Ltd.

B.P. 610, 311. Appl. 38.7.44 (Divided out of No. 610,304). Acc. 14.10.48.
Production of Basic Polyamide. S. J. Allen and J. G. N. Drewitt. To: British Celanese, Ltd.

B.P. 610,345. Appl. 6.3.46 (Adddition to B.P. 560,808). Conv. (U.S.A.) 9.3.45. Acc. 14.10.48.

Adhesive Compositions. J. F. Manning and D. A. Canesi. To: B.B. Chemical Co., Ltd.

An adhesive composition comprising a copolymer of butadiene and acrylonitrile, a volatile organic solvent, a vinyl resin (vinyl chloride-vinyl acetate copolymer) and a phenol aldehyde resin.

B.P. 610,422. Appl. 4.4.46. Acc. 15.10.48.
Manufacture of Flexible Films, Sheets or Threads. E. M. Schaefer. To: Erinoid, Ltd.

Thin flexible plastic films and tapes made from a mixture containing polystyrene and polyisobutylene (not exceeding 8 per cent.) by extrusion.

B.P. 610,547. Appl. 7.1.46. Acc. 18.10.48.
Manufacture of Moulded Component Articles. C. A. Taylor. To: The Rawlplug Co.

B.P. 610,559. Appl. 7.2.46. Conv. (U.S.A.) 30.11.45. Acc. 18.10.48.
Thermally Insulated Containers. To: Wingfoot Corporation.

Re-usable lightweight container made from Pliofilm and a lightweight heat insulating material.

B.P. 610,560. Appl. 1.3.46. Acc. 18.10.48.
Machine for Forming Pellets or Small Particles of Plastic Materials. F. E. Brown.

B.P. 610,562. Appl. 7.3.46. Acc. 18.10.48.
Moulding Solid Articles in Thermosetting Moulding Compounds. C. Lomas. To: Ashdown, Ltd.

Relates to the moulding of solid articles providing means of controlling the disposition of colours in the finished article.

B.P. 610,597/8. Appl. 1.3.46. (Divided out of B.P. 610,560.) Acc. 18.10.48.
Machines for Processing Rubber, Plastics or the like. F. E. Brown.

B.P. 610,728. Appl. 28.12.45. Conv. (U.S.A.) 20.1.45. Acc. 20.10.48.
Synthetic Rubber Compositions and Method of preparing same. J. C. Weptfahl, D. S. Sears and J. W. Martindale. To: B. F. Goodrich Co.

The object of the invention is to provide a method whereby calcium silicate and other precipitated silicates may easily be incorporated in butadiene 1,3 copolymer synthetic rubbers to produce reinforced compositions having high tensile strength and other desirable properties.

B.P. 610,732. Appl. 12.2.46. Acc. 20.10.48.
Treatment of Rubber and other Plastic Non-conductors of Electricity by the H.F. Heating Process. E. F. Powell and S. W. Gough. To: Dunlop Rubber Co., Ltd.

Repair of rubber tyres by R.F. vulcanization. Rubber-ply covered gauze electrode is inserted between tube and tyre and a similar electrode placed outside the tyre. Pressure is obtained by inflating the inner tube; vulcanization carried out in R.F. field. Principle of rubber bag moulding.

B.P. 610,748. Appl. 15.4.46. Acc. 20.10.48.
Moulding Composition and Manufacture of Useful Moulded Products therefrom. C. D. Greaves, W. D. Parker and O. Bethune. To: C. D. Patents, Ltd.

Manufacture of moulding compositions directly from coal.

B.P. 610,749. Appl. 15.4.46. Acc. 20.10.48.
Manufacture of Carbonaceous Moulding Powders and of Moulding Products. J. G. Bennett, C. D. Greaves, E. C. M. Bethune and W. D. Parker. To: C. D. Patents, Ltd.

Manufacture of moulding compositions directly from coal.

B.P. 610,822. Appl. 20.8.45. Conv. (U.S.A.) 12.12.42. Acc. 21.10.48.
Methods of and Apparatus for Coating an Elongated Body of Wire. To: Olin Industries, Inc.

Refers to the coating of wire by extrusion. Details of the die system are given.

B.P. 610,879. Appl. 17.4.46. Conv. (U.S.A.) 21.4.45. Acc. 21.10.48.
Preparation of Interpolymers To: E. I. Du Pont de Nemours and Co.

Refers to copolymers of fluoroethylene.

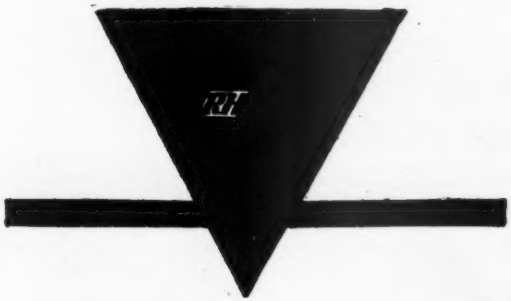
B.P. 610,898. Appl. 2.5.46. Conv. (U.S.A.) 5.5.45. Acc. 21.10.48.
Chloromethyl Silicon Compounds. To: British Thomson-Houston Co., Ltd.

B.P. 610,937. Appl. 11.4.46. Acc. 22.10.48.
Manufacture of Phenolic Resins for Casting. C. A. Redfern and A. M. Brenner. To: Erinoid, Ltd.

Manufacture of phenolic resins suitable for casting by reacting phenol and formaldehyde in the presence of an alkaline catalyst. The reaction mixture is acidified and dehydrated in vacuum and a plasticizer is added. This plasticizer is made by reacting an excess of glycerol with phthalic anhydride.

B.P. 610,962. Appl. 16.4.46. Acc. 22.10.48.
Production of Lenses from Transparent Plastics. J. Johnson. To: Combined Optical Industries, Ltd.

Method of making plastic optically accurate lenses with wear-resisting surfaces by making a preformed blank closely to the



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shape of the desired lens, dipping the blank into a solution of partially polymerized allyl methacrylate in a solvent; preheating the coated blank to softening temperature, subsequently pressing the soft blank between heated steel dies.

B.P. 611,010. Appl. 2.1.43. Acc. 25.10.48.
Production of Polystyrene Compositions. E. W. M. Fawcett, A. Millien and N. Mulhern. To: Anglo-Iranian Oil Co., Ltd.

Production of polystyrene compositions which are not brittle by admixing polystyrene with extracter hydro carbons of non-polar character derived from mineral oil fractions or residues.

B.P. 611,012. Appl. 3.2.43. Conv. (Switzerland) 5.2.42. Acc. 25.10.48.
Esters of Aminotriazine Formaldehyde Condensation Products. To: Society of Chemical Industry, Basle.

B.P. 611,013. Appl. 3.3.43. Conv. (Switzerland) 5.2.42: 7.12.42. Acc. 25.10.48.
Highly Esterified Aminotriazine Formaldehyde Condensation Products. To: Society of Chemical Industry, Basle.

B.P. 611,024. Appl. 8.8.44. Conv. (U.S.A.) 28.4.43. Acc. 25.10.48.
Binders for Use in the Manufacture of Bats, Boards, Sheets or the like of Fibrous Glass A. P. Thurston.

A binder for use in the manufacture of bats, boards, sheets or the like of fibrous glass wherein the binder consists of a mixture of phenol-formaldehyde or urea-formaldehyde synthetic resin, ammonium caseinate—a resin sold under the registered trade mark "Vinsol," mineral oil and ammonium stearate.

B.P. 611,038. Appl. 12.4.35. Acc. 25.10.48.
Plastic Product and Method of forming same. Z. T. Walter.

B.P. 611,060. Appl. 6.11.45. Acc. 25.10.48.
Improved Form of Pliable Container. To: H. H. Kerswell.

Pliable container suitable for spraying powders or liquids consisting of a collapsible outer shell and a hollow inner core consisting of a semi-rigid flexible material which causes the outer shell to take its original shape once pressure on the container is released.

B.P. 611,113. Appl. 18.4.46. Conv. (U.S.A.) 18.5.45. Acc. 26.10.48.
Preparation of Granular Polyvinyl Ethers. C. E. Schildknecht. To: General Aniline and Film Corporation.

B.P. 611.157. Appl. 23.4.46. Acc. 26.10.48.
Production of Styrene Copolymers. To: Standard Oil Development Co.

A preparation of copolymers by reacting styrene and a polyolefin (2-methyl pentadiene) myrcene or allo-ocimene at temperatures below 0 degrees C. in the presence of Friedel-Crafts catalysts.

B.P. 611,164/5. Appl. 24.4.46. Conv. (U.S.A.) 27.4.45. Acc. 26.10.48.
Manufacture of Natural or Synthetic Rubber Sponge. To: International Latex Processes, Ltd.

B.P., 611,228. Appl. 9.11.45. Acc. 27.10.48.
Plastics Moulding Apparatus. To: Improved Paper Machinery Corporation.

B.P. 611,244. Appl. 25.3.46. Conv. (U.S.A.) 23.3.45. Acc. 27.10.48.
Resinous Condensation Products. To: Monsanto Chemical Co.

Refers to the manufacture of melamine formaldehyde condensation products suitable to improve the wet strength of paper or for rendering textile materials water-resistant.

B.P. 611,255/6. Appl. 25.4.46. Acc. 27.10.48.
Low Temperature Polymerization of Olefines. M. D. Cooke and J. J. P. Staudinger. To: Distillers Co., Ltd.

B.P. 611,421. Appl. 15.4.46. Acc. 29.10.48.
Methods of Finishing Surfaces. W. H. Swire and A. Hardy. To: B.B. Chemical Co., Ltd.

Method of lacquering or painting a rubber surface by applying the finishing composition, comprising a copolymer of butadiene and acrylonitrile, a phenol-aldehyde resin and an organic solvent.

B.P. 611,422. Appl. 18.4.46. Acc. 29.10.48.
Production of Shaped Articles from Thermosetting or Thermoplastic Material. R. L. Stephens. To: Communications Patents, Ltd.

Refers to high-frequency preheating of thermoplastic or thermosetting materials.

B.P. 611,425. Appl. 23.4.46. Acc. 29.10.48.
Preparing Organic Silicon Esters. To: Dow Chemical Co.

B.P. 611,473. Appl. 1.5.46. Conv. (U.S.A.) 13.11.45. Acc. 29.10.48.
Assembling Articulated Sheets of Plaques or Buttons. R. Appel.

Relates to handbags made from square, injection-moulded plastic plates which are laced together in an articulated fashion.

B.P. 611,494. Appl. 2.5.46. Conv. (U.S.A.) 5.5.45. Acc. 29.10.48.
Chlorinated Methylpolysiloxane Resins. To: British Thomson-Houston Co., Ltd.

B.P. 611,529. Appl. 1.2.46. Conv. (U.S.A.) 21.2.45. Acc. 1.11.48.
Production of Unsaturated Polyesters and

Polymers thereof. J. A. Bralley and F. B. Pope. To: B. F. Goodrich Co.

B.P. 611,592. Appl. 6.5.46. Acc. 1.11.48.
Manufacture of Laminated Materials. N. W. Knewstubb and C. N. Jenkins. To: Bakelite, Ltd.

Process for the production of laminated material having a resilient and chemically resistant surface layer or layers, which process comprises superposing fibrous sheets coated and/or impregnated with a heat-hardenable resinous binder placing on one or both sides of the stack thus formed a sheet of rubber-like plasticized polyvinyl chloride or plasticized copolymer of vinyl chloride, and subjecting the assembly to heating and to a pressure above, and preferably substantially above, 1,000 lb. per sq. in. to consolidate the assembly and to harden the resinous binder.

B.P. 611,612. Appl. 14.9.44. Conv. (U.S.A.) 14.9.43, 2.12.43. Acc. 2.11.48.
Treatment of Polysulphide Polymers. To: Thiokol Corporation.

Polymeric product produced by reacting a polysulphide polymer in the presence of an oxygen acceptor, thereby causing fission of the polymeric molecules at the—SS—linkages in order to obtain a polymer of lower average molecular weight than the original polysulphide polymer.

B.P. 611,642. Appl. 2.5.46. Acc. 2.11.48.
Composite Materials containing Hydrocarbon Copolymers and Bituminous Materials. To: Standard Oil Development Co.

Method of manufacture for thermoplastic hydrocarbon compositions by homogeneously compounding a bituminous material with a copolymer of an aliphatic monoolefin (isobutylene) and an aromatic monoolefin (styrene) prepared at a temperature below −50 degrees C. in the presence of a Friedel-Crafts catalyst.

B.P. 611,645. Appl. 2.5.46. Acc. 2.11.48.
Apparatus for Heating Insulating Materials by subjecting them to an H.F. Field of Electric Force. J. C. Quayle and P. Jones. To: British Insulated Callenders' Cables, Ltd.

Surface coating for H.F. welding electrodes consisting of "Cordierite" ($2MgO.2Al_2O_3.5SiO_2$). Produced at 1250 degrees C. with a small amount of vitreous binder; this material is a non-porous thermal insulation with good mechanical properties and proof against thermal shock. Purpose: Heat insulation and prevention of sticking of plastic to electrodes. (See also B.P. 577,719.)

B.P. 611,700. Appl. 9.5.46. Conv. (U.S.A.) 26.2.42. Acc. 2.11.48.
Manufacture of Organo-Siloxanes. To: Corning Glass Works.

B.P. 611,708. Appl. 17.3.44. Acc. 3.11.48.
Producing Shaped Articles from a Plastic Composition. To: Columbian Rope Co.

Relates to a method of producing hollow-shaped articles from a plastic composition having in the finished product high impact strength and consisting essentially of fibres and a resin binder.

B.P. 611,719. Appl. 26.7.45. Acc. 3.11.48.
Electrical Components having associated insulating Sealing Material. K. G. Smith and L. G. Newman. To: British N.S.F. Co., Ltd.

An electrical component having a seal of plastic insulating material with a member of non-plastic material emerging from said plastic material wherein said member has formed thereon a surface or surfaces so shaped and disposed that the pressure of said plastic material against said surface or surfaces is increased by shrinkage of said material.

B.P. 611,796. Appl. 9.5.46. Conv. (U.S.A.) 7.6.45. Acc. 3.11.48.
Improving the Physical Characteristics of Vinyl Resin Filaments, Threads, Yarns and the like. T. A. Field, Jr. To: Carbide and Carbon Chemicals Corporation.

QUALITY CONTROL IN PLASTICS MOULDING

(Continued from page 224.)

structed thereon to make the graphs ready for use in conjunction with a production run.

The tables for the assemblage of data, as depicted at Figs. 2 and 3, will be found exceedingly useful for reference purposes and should be retained.

In this simple way a number of vital considerations may easily be assessed and solved, and tables of this type will be found especially advantageous for use in connection with multi-impression moulds. Similar tables of a more simple character should, of course, be employed for collating the data required for any introduction of quality control.

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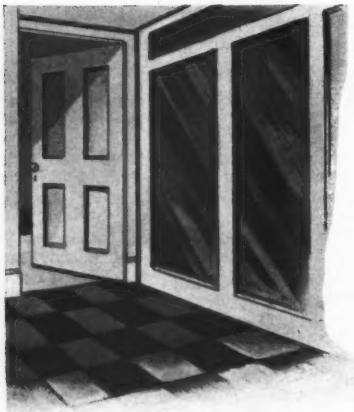

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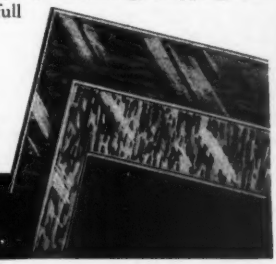

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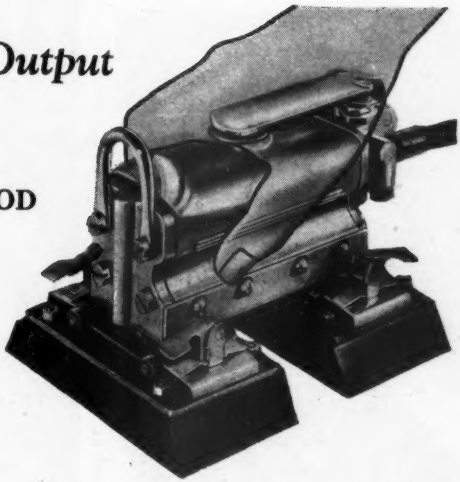

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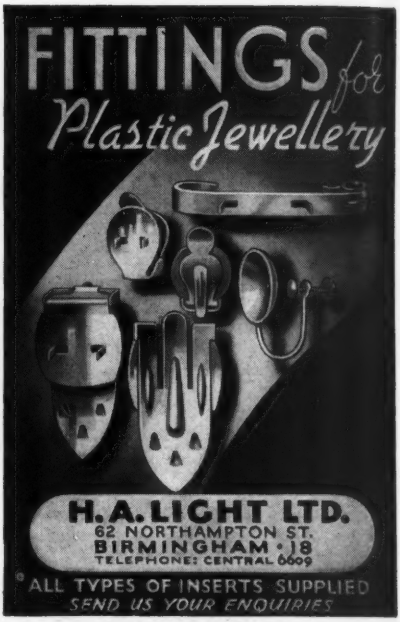

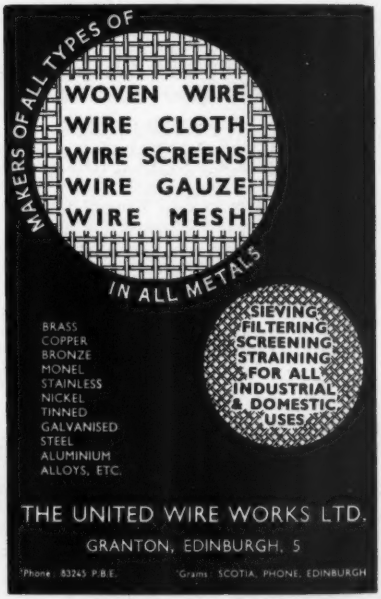

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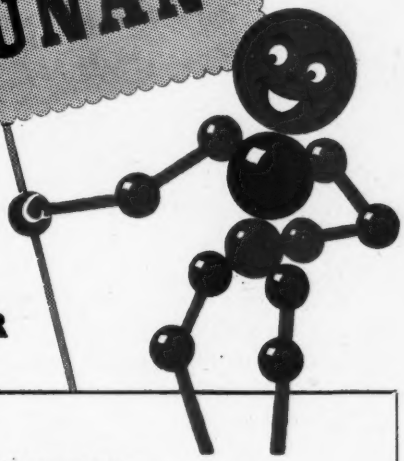

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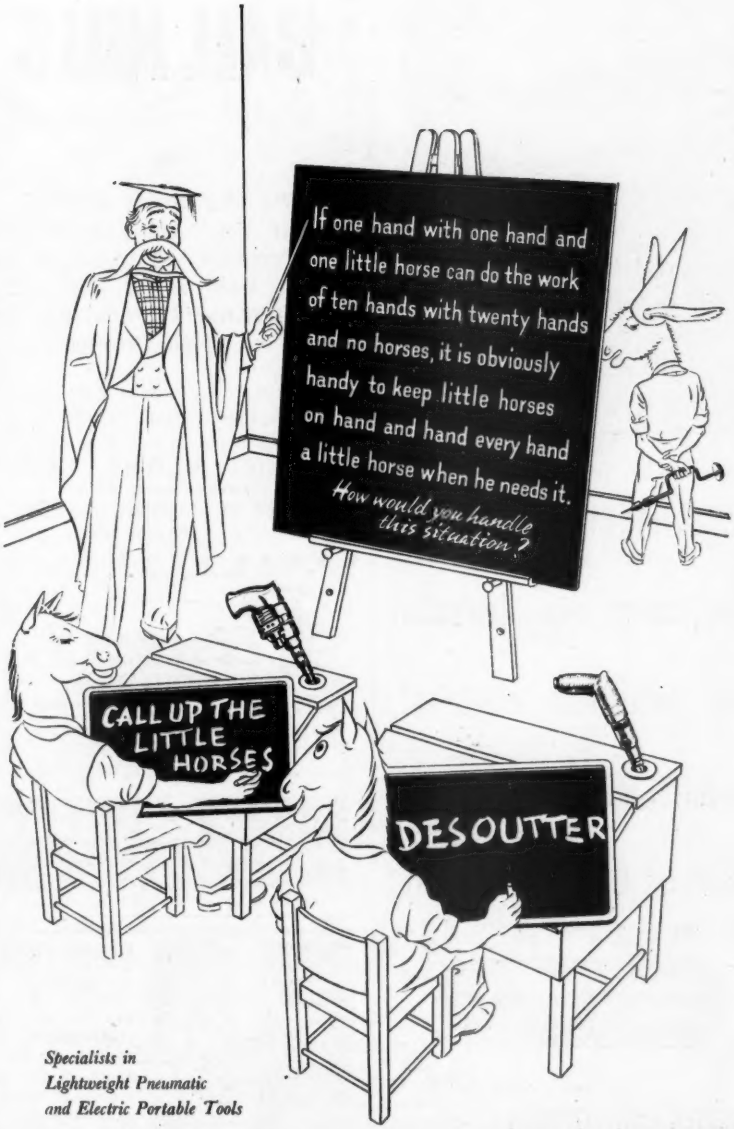
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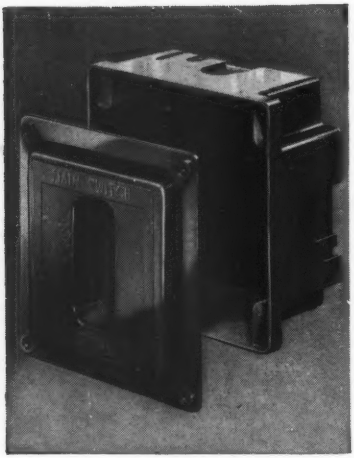

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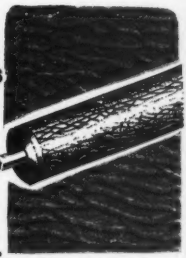

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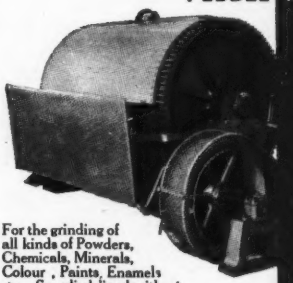

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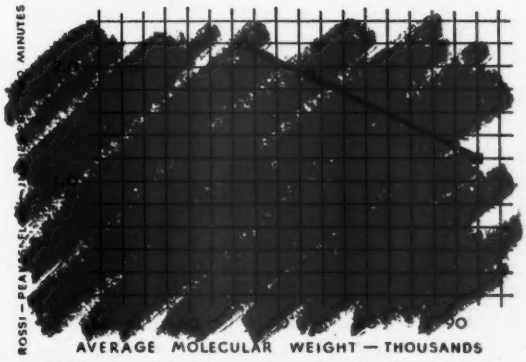

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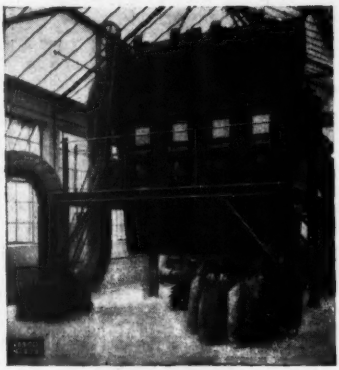

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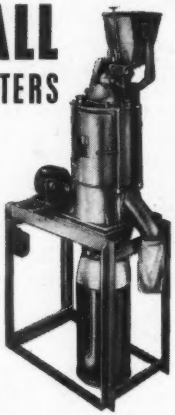

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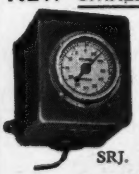

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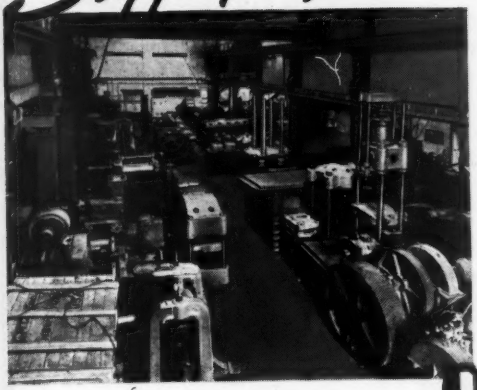

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Freehold, three miles west of Marble Arch. Main road, Shepherd's Bush. 1,000-ft. workroom plus good ground-floor shop, £4,750 or possibly let to at least 15-year purchase tenant. Owner, 3 Windsor Road, W.5. 143-x5149

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Specialists in tool design and injection moulding offer their many years of practical experience to designers and patentees of new articles, or will advise firms or individuals requiring assistance in moulding and marketing of ideas. Box P3920, care of "Plastics." zzz-244

FINANCIAL AND PARTNERSHIP

Engineer who owns granted patents in all principle countries for a new plastic zip fastener, fully developed for production from nylon, seeks interested parties with capital £5,000 to £10,000 to start production on a large scale, or would sell outright, samples and production can be inspected; sound business proposition; all replies strictly confidential. Write Box P4319, care of "Plastics." 143-13

MACHINERY, TOOLS AND PLANT

Alternators, Diesel sets, electric motors, switch gear, transmission equipment, fluorescent lighting and industrial fittings, ex stock. Keen prices. Contact G. L. Murphy, Ltd., Menston, near Leeds. zzz-210

Twelve plating vat rumblers by Cruickshank, 18-in. diam. by 21 ins. deep, belt driven, £25 each. Thompson and Son (Millwall), Ltd., Cuba Street, London, E.14 zzz-234

Two die-casting machines, goose-neck type, hydraulic operation with gas-fired furnace and motorized pump, one automatic and one semi-automatic, 8 lb. capacity, by the French Oil Co., U.S.A., good condition.
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Shaw hydraulic accumulator, 120 tons cast iron weight loaded type with three throw pumps, not A.C 415.3/50, latest design, as new.
Two Shaw hydraulic presses, 60 tons, four columns, platens 3 ft. 6 ins. by 4 ft., daylight 6 ft. 6 ins., as new
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Machinery, Tools and Plant (contd.)

Plaster Casting improved by new flexible mould Dohm, Ltd., 167 Victoria Street, S.W.1. 146-735

Quantity of rubber or plastic spreading machines by Platt Bros. and Co., Ltd., complete with hoods and in good condition, roller width 63-in. Apply: Woodfield and Turner, Parsonage Mills, Burnley. Phone 3065. 145-822

Impetus new motorized 13-speed ½-in. cap drilling machines from stock, £18. Complete machine catalogue from manufacturers. John P. Steel, Dept. 8, Bingley, Yorks. Phone 1066 (4 lines). 145-930

150-TON FAWCETT PRESTON SEMI-AUTOMATIC SELF-CONTAINED MOULDING PRESS

Fitted electrically heated platens 20-in. square; Fraser Mono Radial motor-driven Pump with oil tank, etc.
3-oz. T.M.A. Injection Moulding Machine, Model S.H.3.
REED BROTHERS (ENGINEERING), LTD.,
BEVIS MARKS HOUSE,
LONDON, E.C.3.
Phone, Ave 1677-8. 143-34

For sale, five plastic injection moulds for T.M.A. S.H.3. machines; three comb moulds, all two-impression; 6-in. and 7-in. tail and dust; two impression egg cup and six impression child's knife, fork and spoon. Sample mouldings or further details on request. Offers around £400 the lot. Box P434, care of "Plastics." 143-x4232

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FIVE NEW DRILLED STEEL STEAM PLATENS
54-in. by 38-in. by 2-in.
Immediate delivery.
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John Downham spreading machine complete with calender and doctoring units, fitted with steam coils, reduction gear and variable complete; has done less than 100 hours' work. Hemmings, Ltd., 179 St. Albans Road, Watford. 143-x4519

For sale, plastic moulds for hair-combs, two-, four- and six-cavity plates, laying in London. Particulars, John Sulley and Sons, 83 Cannon Street, E.C.4. Phone, City 2231. 143-27

"Keller" toolroom milling machine, 24 by 16 by 8, suitable production all classes dies, patterns, profiling and three dimensional; fully automatic push-button electric and hand control all movements, complete all electrical equipment, fixtures, tools, spares, an excellent tool in practically new condition. Box P4329, care of "Plastics." 143-6

Manufacture of plastic teeth. Complete equipment capable of producing at exceptionally low cost over 100,000 teeth monthly, to be sold outright, or proprietor prepared to retain small interest in business; would help start manufacturer and train personnel. Parties with available capital and references apply to Box P4330, care of "Plastics." 143-5

Practically unused, due to cancellation of contract. Nene Valley 45-gram hydraulically operated injection-moulding machine, plasticizing capacity 20 lb. per hr., mould clamp 40 tons, platen area 7-in. diameter, injection pressure 16,000 per sq. in., thermostatically controlled, one lever operating complete cycle, 400-440-volt, three-phase, 50 cycles. Box P4334, care of "Plastics." 143-1

High-speed routing machines by Wadkin for sale, model LE with radial arm, suitable for wood, metal or plastics, speed of head 24,000 r.p.m., radius of arm 66 ins. with rise-and-fall head, frequency changer, suitable for 400 volts, three-phase, 50 cycles. F. J. Edwards, Ltd., 359 Euston Road, London, N.W.1. Euston 4681. 145-933

4-in.-wide belt grinders or sanders, essential for plastic industry, £6 10s., or motorized £15 10s. Also 6-in.-wide belt, ditto. Manufacturers, John P. Steel, Dept. 8, Bingley, Yorks. Phone 1066 (four lines). 145-931

—MACHINERY, TOOLS AND PLANT WANTED—

One pair of powder weighing scales, preference Avery or Hodgkinson Type B, to weigh up to 2 lb. in 1/16 drams divisions. Box P4325, care of "Plastics." 143-28

Wanted, one T.M.A. S.H.3 injection moulding machine, 65-ton locking supply. Details to Box P4327, care of "Plastics." 143-8

Injection moulding presses, one or two second-hand 4 oz. E.M.B. machines required; must be in first-class condition. Box P4335, care of "Plastics." 143-43

Wanted, injection moulding machines, medium or large sizes. Box P4336, care of "Plastics." 143-46

PRODUCTION CAPACITY AVAILABLE AND WANTED

Dohm, Ltd., pulverize raw materials everywhere. 167 Victoria Street, London, S.W.1. zzz-224

Injection moulding specialists have moulding capacity up to 4 oz. Consultants on all injection moulding problems. Please send inquiries to Box 5328, care of "Plastics." zzz-236

Injection moulding capacity available on 3-oz. injection moulding machine for short and long runs. Box 5327, care of "Plastics." zzz-235

P.V.C. silk screen printing. Table cloths, curtains, nursery patterns, etc. Capacity available for quantity runs. Quality work. Daily deliveries. Guaranteed adhesion and fastness of colour. Davis (Patents), Ltd., 18 Phipp Street, London, E.C.3. Bishopsgate 2939, 5091. 143-538

Repetition in Ebonite, Erinoid, etc. Capstan lathe work. Mansell, Temple Street, Rugby. 149-543

Injection moulding capacity available. I.O.G. Industries, Ltd., 41 Marshgate Lane, Stratford, E.15. Phone, Maryland 2804. 143-737

Injection mouldings in therm-plastics. Mouldings in styrene, acrylics and acetate. Design and toolroom facilities available for mould construction. Inquiries invited. J. and E. Courtnay, Ltd., 138 Stratford Road, Birmingham, 11. 144-823

Injection moulding by I.O.G. Industries, Ltd., 41 Marshgate Lane, Stratford, E.15. Maryland 2804. 145-927

Printing, engraving, etc., on all types of plastics. Modern Plastics, Ltd., Kangley Bridge Road, S.E.26. 148-929

10,000 sq. ft. of modern factory space (near Hitchin, Herts.) surplus to our requirements, together with labour and capital. Open to consider any sound and profitable business proposition for use of same. Box P4318, care of "Plastics." 143-14

B. and S. Tools, Ltd., 45a Branston Street, Birmingham, 18, have additional capacity for manufacture of plastic and rubber moulds, jigs and fixtures, light engineering, and special purpose machines. Inquiries invited. Phone, Cen. 1166. 143-44

Fairman Precision Tools and Products, Ltd., of Horley, Surrey, have capacity for the manufacture of bakelite and plastic moulds, diecasting dies, press tools and special purpose machines. Also all classes production machining. Phone, Horley 909. 148-936

"Impossible" moulding propositions invited by pioneer injection moulders with unusually qualified staff and most modern capacity up to 12 oz. Inquiries in strict confidence and without obligation. Box P4337, care of "Plastics." 143-47

—RAW MATERIAL AVAILABLE AND WANTED—

Cork! Cork! British Cork Mills, Ltd., 167 Victoria Street, London, S.W.1. Vic 1414-6. zzz-238

Buna-plast, a blending of synthetic rubber and P.V.C. specially processed for manufacturing leather substitute; this material is far superior to plasticized P.V.C. Inquiries welcomed. Dohm, Ltd., 167 Victoria Street, London, S.W.1. zzz-230

P.V.C. calendering compound in a range of opaque colours. Dohm, Ltd., 167 Victoria Street, London, S.W.1. zzz-229

Polystyrene moulding scrap urgently required, state amount available and send small sample. Box 3185, care of "Plastics." zzz-228

Polythene moulding powder (reconstituted) in black natural and a variety of colours. Dohm, Ltd., 167 Victoria Street, London, S.W.1. zzz-226

Metal powders and oxides. Quotations and samples on application. Dohm, Ltd., 167 Victoria Street, London, S.W.1. zzz-225

Ebonite and bakelite always in stock. Phone, Archway 3654. A. E. Goodeve, Ltd., 188a Seven Sisters Road, London, N.7. 151-634

Raw Material Available and Wanted (contd.)

MOON AIRCRAFT, LTD.,
SPECIALISTS IN MANIPULATED AND FABRICATED WORK.
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Have available from stock all thickness in clear and colour flat sheet cut to customer's sizes.

Inquiries, prices and particulars upon application to CLIFT WORKS, BOX, WILTS.
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London Office:
GROSVENOR GARDENS HOUSE, S.W.1.
Phone, Victoria 9182-3. 144-592

Reclaimed X-ray sheet, blue tinted. Sizes 6 ins by 4 ins., 8½ ins by 6½ ins., 10 ins. by 8 ins., at 1s. 9d. per lb. in 1-ton lots; size 12 ins. by 10 ins., at 2s. per lb. in 1-ton lots; size 15 ins. by 12 ins., at 2s. 6d. per lb. in 1-ton lots; size 17 ins. by 14 ins., at 3s. per lb. in 1-ton lots. Intermediate sizes also available. Delivery from stock.

Reclaimed nitrate X-ray sheet, various sizes, at 1s. 3d. per lb., in 1-ton lots; 5 tons available.

Scrap Perspex, clear, transparent, various sizes, thicknesses and shapes, 1s. per lb., in 1-ton lots; 5 tons available.

Plastic scrap, very mixed assortment, colours and shapes, 6d. per lb., in 1-ton lots; 5 tons available. Acetate flakes, clear, transparent, 9d. per lb., in 1-ton lots.

Clear transparent acetate sheet film, 10 ins. by 6 ins., 10-tho. thick, brand-new material, 3s. 6d. per lb., in 1-ton lots.

Lloyds, 4-5 Church Street, Christchurch. Phone, Christchurch 504. zzz-241

Virgin cellulose acetate moulding powder in transparent, transluscent and opaque colours, three-flow grades, now available from stock at reasonable prices. Dohm, Ltd., 167 Victoria Street, S.W.1. zzz-249

P.V.C. offcuts and scrap. Manufacturers are interested in purchasing clean scrap and offcuts, particularly natural, direct from makers-up. Substantial regular quantities required. Please send samples with particulars of price and approximate quantities for a continuous contract, to Box P4122, care of "Plastics." 143-729

Always large stocks of
CASEIN
rods, tubes and sheets,
PERSPEX
sheets up to 1-in. thick,
CELLULOSE ACETATE.
S. Rosenfeld,
93 Aldersgate Street, E.C.1.
Phone, Monarch 4686. 146-594

"Perspex" offcuts. Required, large or small quantities. Please write J. E. Hoare (O.T.S.), Ltd., 134-144 High Street, S.W.17. 144-732

J. H. Berry (Plastics).
Recognized stockholders of "Perspex" acrylic sheet. Large and varied stocks in clear and coloured always on hand.
Catalin in a variety of sections.
Crinothene. Full rolls or cut sheet supplied.
Special offer. Plastic thonging, 3 mm. by 1 mm., 50s. per 1,000 yds. "Tenaplas" plastic wire, covering tube ⅛ in. by .5 in., ivory, 40s. 1,000 ft., 2 mm. by .5 in., in a variety of colours, 27s. 100 ft.
Plastic-covered twin-core electric cable, 23/36 by .65, 8s. per 100 ft.
Linen bases "Tufnol" and "Bakelite" sheets, ⅛ in. and 5/32 in.
J. H. Berry (Plastics), Annesley Woodhouse, Notts. zzz-246

Accurate powders for ceramic, alloy, plastic, paint, etc., industries. Dohm, Ltd., Pulverizers, 167 Victoria Street, London, S.W.1. zzz-248

Wanted. Cellulose acetate new polished sheeting, in transparent and cream, 25-35 thou. Write Box 4331, care of "Plastics." 143-4

Raw Material Available and Wanted (contd.)

OFFERS INVITED.

Manufacturers having no further need for them invites cash offers for the following:—

Approximately 1½ tons of benzyl acetyl ricinoleate, and 5 tons of tributyl citrate, supplied by Lankio Chemicals, Ltd., and A. Boake Robert, Ltd., respectively. Write

POLYESTOL, LTD.,
3-4 WARWICK COURT,
HOLBORN, W.C.2.
143-26

For sale. Urea powders, 3½-tons each red and turquoise, ½-ton blue. Phenolic powders 10-tons walnut first quality, also 70 tons black, slightly contaminated with polystyrene (cheap). New acetate sheeting 20-30-1,000 in blue, orange and white. Details from Box P4317, care of "Plastics." 143-15

Cellulose acetate clear and colours, 3 thou.-3 mm., from stock. Also reclaimed X-ray sheets all sizes. Morol, Ltd., 21 Woodthorpe Rd., Ashford, Middx. 143-23

Plastic sheeting for bags in grains as:—crocodile, lizard calf, pinseal, morocco, etc. Fine sheeting in many shades. Piping, strapping, tubing, rivets, suedeen, linings, leathercloth. Delivered from stock. D. Meyer, 58 Great Marlborough Street, London, W.1. Phone, Gerrard 3391. 143-24

Perspex surplus stocks, immediate delivery, 300 assorted sheets 48-in. by 36-in., cheap for quick sale; also black acetate 40-thou. and 60-thou. Box P436, care of "Plastics." 143-x4233

Woodflour 90 mesh B.S., 10 tons available from stock. Please write or phone: T. Berkovits and Co., Ltd., 36 Atwell Street, London, S.E.15. Phone, New Cross 2479. 143-36

For disposal, large quantity of urea formaldehyde moulding powder, white and blue in powder and granular form. Inquiries to Box P33, L.P.E., 110 St. Martin's Lane, W.C.2. 143-37

3 tons new coloured Perspex scrap; 2 tons transparent Perspex panels, 24 by 18 by ⅛, slightly curved on end; 100 sheets frosted Perspex sheets 30 by 40 by ⅛. Stamford Metal Co., 54a Newington Green, N.16. 143-39

For sale, 1½ tons of Bakelite black moulding powder, ref. No. Grade A.X10894, packed in cwt. drums, material perfect condition, cost 1s. 7d. per lb., accept 9d. per lb. to clear. Sample sent on request. Davidsons (Manchester), Ltd., Hayes Yard, Garratt Street, Manchester, 10. Phone, Col 1610. 144-932

Perspex! Perspex!! Perspex!!! Official stockists for I.C.I. acrylic sheet. Sheets cut to your requirements. Fabrication and moulding specialists to the trade:—S. C. Errington (Hanwell), Ltd., 132a Uxbridge Road, Hanwell, London, W.7. Phone, Ealing 5288. zzz-251

For sale, Casein (Lacrinoid), 30 1-cwt. drums, £150 or offers. Lea, 54 Abbey Street, Nuneaton. 143-x4792

Scrap. Why not let a well-established firm quote you for cellulose acetate, polystyrene and other thermoplastic off-cuts and scrap? Having best use for these materials, highest prices can be paid. Quotations on receipt of representative samples to M. H. Grist (Plastics), Ltd., 82-84 Brighton Road, Surbiton, Surrey. Phone, Elmbridge 4214. 143-41

Coloured "Perspex" scrap and all thermoplastic scraps collected from your works at the best terms. Micheal S. Stevens, Ormond Road, Richmond, Surrey. Phone 0211. 143-40

Wanted, thermoplastic moulding powders and moulding scraps, all kinds. Offers and samples to Box P4338, care of "Plastics." 143-48

TRANSPARENT ACETATE.

60 Thou. 500 lb. each Green, Blue and Smoke, perfect as delivered by British Celanese.

Also

40 Thou. 1 ton Transparent Sheets, 56 ins. by 24 ins., 4s. per lb. to clear lot.

Large stocks of Acetate in clear and colours, 3 Thou.-40 Thou.

ALLANS,
37 FARRINGDON STREET,
LONDON, E.C.4
Central 5947. 143-45

Raw Material Available and Wanted (contd.)

D. H. Ridout and Son, Ltd. Reg. Office, 12 Stedman Road, Southbourne, Bournemouth. Phone, Southbourne 505.
Official stockists for I.C.I. acrylis Perspex, crystal and coloured, and "Crinothene" sheeting in all shades.
Offer acetate and celluloid transparent sheeting from 2s. per lb.
Bakelite laminated sheeting from 1s. 10d. per lb.
Coloured and clear Perspex off-cuts at 1s. 3d. to 2s. per lb., according to gauge and quantity required.
All types of plastic tubes and rod from 4d. per ft.
1¼-in. ribbed plastic belting at 6d. per yd.
Perspex No. 6 and No. 2 quick-drying cements and polishes.
Special offer of 1-oz. and ½-oz amber bottles with plastic screw stopper at 15s. per gross.
Send for new stock list which contains numerous interesting items to opticians and manufacturers of finished plastic goods.
Surplus stock purchased.
D. H. Ridout and Son, Ltd., Stedman Road, Southbourne, Bournemouth. 143-42

SITUATIONS VACANT

None of the vacancies in these columns relates to a man between the ages of 18 and 50 inclusive, or a woman between the ages of 18 and 40, inclusive, unless he or she is excepted from the provisions of the Control of Engagement Order, 1947, or the vacancy is for employment excepted from the provisions of that Order.

Works engineer with first-class knowledge of general rubber manufacture required for a group of new factories being opened in Monmouthshire by Brynmawr Rubber, Ltd., a new subsidiary of Enfield Cables, Ltd. At least 1,000 people to be employed under good working conditions. Main factory at Brynmawr will be available in 1950; two smaller factories already in operation nearby. Experience with rubber and plastics essential, including rubber mouldings, mechanicals, sheet, sponge and latex, also design of tools. Mechanical qualifications must be good, electrical less important. Temporary accommodation now available, new house early 1950. Write full particulars and salary required, in confidence, to Managing Director, P.O. Box 7, Enfield, Middlesex. 143-10

Working foreman, plastic moulding (compression), required by small firm in Essex. Shift work entailed. Permanent and well-paid position for the right type of man. Send fullest details and wages required to Box P419, care of "Plastics." 143-05

Representatives required immediately already calling on factories, wholesalers or retailers, caterers or canteens, for all main Counties, readily saleable product. Reply Box P432, care of "Plastics." 143-x3514

Graduate chemist for Plastics Section of the Technical Department, B.I.C.C., Ltd., Leigh. Applicants should have experience in handling and compounding thermoplastic materials, P.V.C., etc., preferably for insulating purposes. Salary according to ability. Five-day week. Write, stating age and experience, to Staff Officer, B.I.C.C., Ltd., Cable Works, Leigh, Lancashire. 143-33

Plastic manufacturers, N.E. London area, require assistant chemist, aged 20-25, inter B.Sc. standard, for production laboratory. State age, education, experience and salary required. Strictest confidence. Apply Box P4333, care of "Plastics." 143-2

Planning engineer required by progressive firm in S.W. dealing only in Perspex. Write, giving details of age, experience, present position and salary, to Box P4332, care of "Plastics." 143-3

Technicians for Israel experienced in manufacture of adhesive tapes or P.V.C. paste leathercloth. Apply, stating age, experience and qualifications, if any. Box P4326, care of "Plastics." 143-9

Established firm of plastic moulders require representatives, preference given to applicants with connections and knowledge of the trade, salary generous in accordance with ability, permanent position. Box P423, care of "Plastics." 143-820

Composition board manufacturers require the service of fully experienced chemist. Experience in factory organization and management, also working knowledge of engineering would be an advantage. Send full particulars including salary required to Box P4324, care of "Plastics." 143-29

Fully experienced foreman for small injection moulding shop in N.W. London. Knowledge of hydraulics an advantage. Send fullest details and salary required to Box P4323, care of "Plastics." 143-30

Situations Vacant (contd.)

WANTED.

Leading and well-established company in the plastic field, creating new and novel applications in toys, household goods. Christmas-tree ornaments, musical and stationery items, requires

SALES MANAGER

with administrative ability, to take complete charge of home and export sales. Interested only in top personality, well connected with wholesale and chain-store outlets. Remuneration: Salary commission and profit sharing.

Reply in first instance, in strict confidence, giving full details of experience and background, to Box P4310, care of "Plastics." 143-22

Sales Manager. Plastic moulding concern, North London. Excellent prospects, good salary. Full particulars to Box P4322, care of "Plastics." 143-31

Male moulders required for bakelite moulding factory near Woking, Surrey. State details of past experience and salary required to Box P433, care of "Plastics." 143-x3602

Manager required for developing new departments in an established factory in the Home Counties. Managerial and engineering experience essential. Salary according to qualifications, but not less than £1,000 p.a. Write for application form to Box P4321, care of "Plastics." 143-12

Salesman required to help develop industrial applications division of moulders (compression and injection) and fabricators. Headquarters London. Write in first instance, giving qualifications and experience. Box P4316, care of "Plastics." 143-16

Calender man wanted for the West Country with an all-round experience on P.V.C. sheeting and fabric coating, good rate of pay and opportunity of overtime. Apply, giving full details of experience, age, etc., to Box P4315, care of "Plastics." 143-17

Experienced jig and mould maker required for tools for Perspex and cellulose acetate sheeting. Box P4314, care of "Plastics." 143-18

Engineer sales representative required by large progressive company in the North West for marketing of technical plastics. Replies, stating age, full details of experience and salary required, to Box P4313, care of "Plastics." 143-19

A vacancy occurs in the development department of a well-known company in Derbyshire for a young man to act as deputy to the head of the department. Minimum qualifications Grad.I.Mech.E. Knowledge and/or experience of plastic materials and/or mould design essential. Knowledge of chemical engineering an advantage. Commencing salary £400-£600 according to age, qualifications and experience. Apply, Box P4312, care of "Plastics." 143-20

Experienced plastics salesman, must have good connection with commercial users of plastic mouldings. Write, in confidence, stating qualifications, salary, etc., to Box P4311, care of "Plastics." 143-21

Wanted, foreman for medium-sized injection moulding shop, London, toolmaker an advantage, drive and organizing ability essential, first-class man only. Box P4339, care of "Plastics." 143-49

Rubber works manager, with first-class knowledge of general rubber manufacture, required at once for group of new factories being opened in Monmouthshire by Brynmawr Rubber, Ltd., a new subsidiary of Enfield Cables, Ltd. At least 1,000 people to be employed under good working conditions. Main factory at Brynmawr, with modern mill-room equipped entirely with Bridge machinery, will be available in 1950; two smaller factories already in operation nearby. Successful applicant must combine sound experience in up-to-date management techniques, together with knowledge of rubber and/or plastics manufacture. A new house is immediately available. Write full particulars, in confidence, to Managing Director, Enfield Cables, Ltd., Brimsdown, Middlesex. 143-11

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Sales Manager, age 40, extensively travelled, 15 years' experience, 10 years' plastics, from all angles. Seeking change, offering scope and opportunity. Fully qualified all branches sales management. Box P435, care of "Plastics." 143-x4027

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Thermoplastic extrusion specialist, having wide experience in all branches of wire, cable and special section industry, would like to communicate with any organization of repute who would be interested in employing him in a managerial position. Box P438, care of "Plastics." 143-x4518

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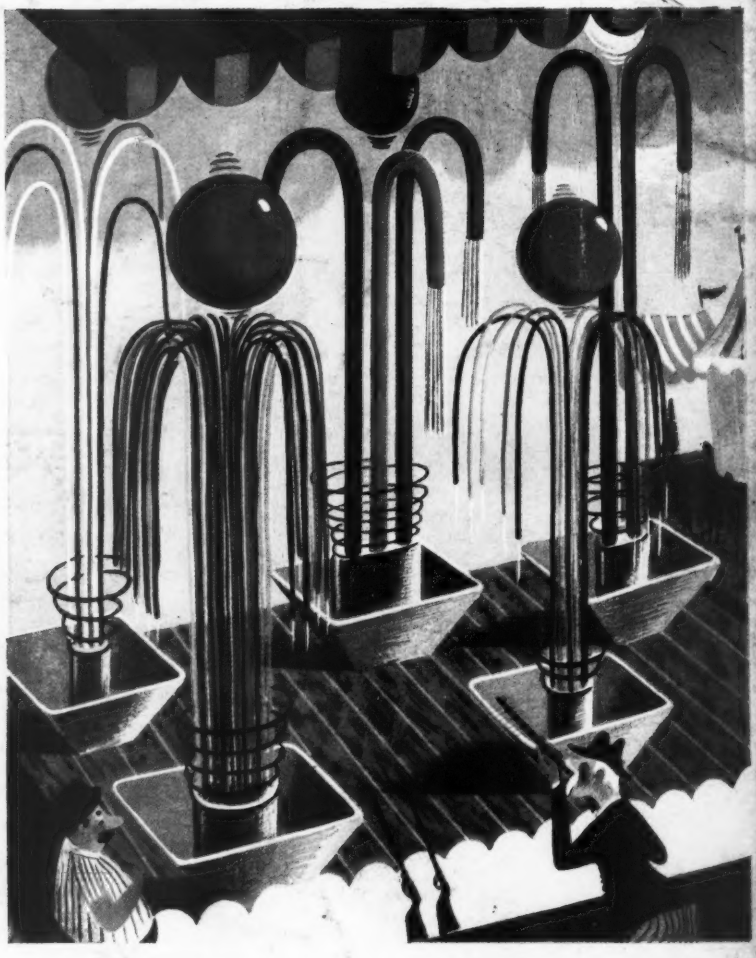

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